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WATERS OF WESTERN INDIA.

PART II.—KONKAN AND COAST.

(By a Member of the Society.)

THE region of the present paper is included, roughly speaking, between the 16th and 21st degrees of North Latitude and between the watershed of the Sahyadri Range, with an average elevation of about 3,000 feet (rising in places to 4,500) and the outer line of soundings, where they increase suddenly, though very irregularly, at a distance of about 60 nautical miles from the coast.

The mountains, the coast, and the line of deep water are pretty nearly parallel, running from south-east to north-west, with a slight westerly divergence in the coast-line and a more marked one in that of soundings.

The whole region forms the face of the Deccan trap area, descending westwards into the ocean by a series of the terraces or steps which characterize this formation and have given it its name (trappa=step in Swedish or Danish).

Fresh and salt water are so much mixed up in parts of this region that it is convenient to take the whole together in rough notes like the present.

Between the crest of the Sahyadris and the edge of the series of cliffs which form most of their western face is a narrow highland zone called the "Konkan-Ghát-Mátá," or "Konkan on the top of the gháts." "Mátá" in Maratha means the top of anything, from a skull to a mountain, whence, for instance, Materan ("The jungle on the hill-top").

The longest torrent of the Konkan-Ghát-Mátá is probably the Kumbhe nullah, with a course of five miles ; and I suppose that the little tank at Khandala is its largest sheet of standing water. The torrents, which are very numerous, generally contain water here and

there throughout the year : in potholes under falls, or at spots where springs occur in their beds.

These are inhabited by characteristic little fishes ; loaches (*Nemachili*) and mountain carps (*Discognathi*). There do not seem to be many species. I could only distinguish two loaches and one cyprinoid amongst many hundred specimens collected from every spring and stream in the basin of the Savitri. The cyprinoid seems to have the characters of Dr. Day's *Discognathus* (*olim Mayo*) *modestus*, a species which he bases upon two specimens in the Calcutta Museum, and supposes to belong to Northern India. Lieutenant Beavan remarks on its similarity to his *Dicognathus macrochir*.

One of the loaches is apparently *Nemachilus rupelli* ; the other I could not identify. All three seem to live chiefly on green water mosses coating the stones of the streams ; but they are probably pretty omnivorous. They form a sort of Alpine club ; there is no tiniest spring that does not hold them ; and the hillmen all maintain that they ascend by leaving the rivers during the rains, and literally climbing up the mountain sides at that time streaming with water.

From some experiments that I made, I think that this extraordinary statement is probably true. The most remarkable other inhabitants of the Ghát-Mátá waters are certain highland periwinkles (*Cremnoconchi*), whose resemblance to the Marine Littorinæ (which people buy by the pint and eat with pins) has given rise to conjecture that they may be descended from "winkles" that inhabited the Ghâts when these were washed by a prehistoric ocean. They seem to sleep in concealment during the dry weather, and come out in swarms in the rains, when some of the hillmen collect and eat them. The tiny fishes that I have mentioned, averaging perhaps an inch and a quarter in length, furnish little food ; and accordingly we have here no aquatic mammal and few birds to notice. The Three-toed Kingfisher (*Ceyx tridactyla*) is the most characteristic. *Halcyon leucocephalus* and *smynensis* occur, and probably the rare *H. pileata* and *chloris*. *Alcedo bengalensis* is common ; and perhaps *Alcedo beavani* may be found hereafter.

The ubiquitous Paddy-bird and "Did-ye-do-it," and the smaller Sand-pipers, frequent the streams ; and the few and small tanks are used as resting-places by migrating Ducks and Teal.

The rivulets of the Konkan-Ghát-Mátá fall over the black cliffs of the Ghâts in innumerable cascades, separated by the terraces which run along the face of the mountains. Down to about 500 feet above

sea-level there is no change in their population ; but here we find a tiny prawn associated with the loaches and *Discognathus modestus* ; and below this we come upon *Discognathus lamta* and a number of small Barbel and Carps, mostly, I suppose, fry of large species. Near the same level we begin to get a small Murrel ; and at the next step downwards the torrents unite to form small rivers, flowing through valleys of which the bottoms are usually under rice-cultivation.

These rivers very much resemble those of the Western Deccan described in my last paper ; but before they have time or space to unite and form important channels, they meet with the salt water. Probably no river of the Konkan has a perennial fresh-water stream fifty miles long.

There are however many deep potholes under falls ; and in some places long reaches of still water are formed by natural trap dykes crossing the streams or by artificial dams.

Some of the valleys are mere gorges ; others are of considerable width ; and these latter have usually flat bottoms, and appear to have been lakes within (geologically) recent times. Many of my readers are probably familiar with the theory that the basaltic floor of the Konkan, or at least of that part of it near Bombay, did, within the present period, sink westwards, somewhat as ice sinks from the shore when the water fails under it, immersing its western edge in the sea, and forming, amongst other things, Bombay Harbour, where there had probably been a lake surrounded by forest. In digging the Prince's Dock, a forest of Kheir trees (*Acacia catechu*) was found *in situ*, very much as you may see to-day the same trees growing in the forests of Mosare and Kirawli, five and twenty miles away ; and recent excavations in the salt marshes of Uran showed numerous roots and twigs with the bark on them : these however were not identified, and may have been mangroves ; but even this implies a depression of their bed, as mangroves do not grow below low-water mark.

The lacustrine remains found in the Island of Bombay itself may perhaps belong to another period. I am not personally acquainted with them.

But the recent depression that let the sea into Bombay Harbour would naturally spill the fresh water out of lakes lying further east, such, for instance, as the wide Panwell Basin, over which people look towards Bombay from the west edge of Matheran, or from the reversing station on the Bhore Ghât. The same thing probably

happened to the valleys of the Kundlika and the Mangaum Kál. The line of disruption has never been exactly traced; but it is suggested that some clue to it may be obtained from the hot springs; and in that case it probably begins near Mhad, and runs through the valley of Mangaum and the very curious little defile of Ratwad, the Sukeli Pass, and the salt marshes east of the harbour; then between the Parsik and Matheran Hills, and past Bliwandi to Akloti on the Tansa River.

This however is all mere conjecture at present; and the main importance of the great break off to our subject is that it left us not a single lake in a country that was once probably a "lake region," and gave us instead estuaries in which the salt water often gets 30 miles from the sea. In some places on these creeks the mountains close in on the channel, and these defiles are often very picturesque.

But generally there is more or less flat salt marsh on one or both banks of each creek, sometimes reclaimed and converted into salt rice-land or salt-pans, but often covered with a dense growth of mangrove bushes, which grow to 25 or 30 feet high. The reclaimed lands are irredeemably ugly during eight months of the year; the mangrove swamps and islands, on the other hand, are very pretty at a distance or when the tide is in. At low water they are not pleasant neighbours from the heavy smell and hideous appearance of the bare mud about their roots, pierced by innumerable spiky and leafless suckers. The trees are not always true mangroves (*Rhizophoreæ*); indeed these are comparatively rare to the north of Bombay, but more abundant as you go down the coast southwards. The native name for them is *Kandel*, and they are easily distinguished by their strange flying buttress-like roots, glossy foliage, and flowers sometimes conspicuous and sweet-scented. Of this order, we have species of *Rhizophora*, *Ceriops*, *Kandelia*, and *Bruguiera*, and of others the "Tiwar" (*Avicennia tomentosa*) and "Surund" (*Excoecaria agallocha*), both of which are useful forage plants, "Phungali" (*Excoecaria majus*), with white flowers, and the strange "Marendi," or "Creek Holly," for which I have only a very old botanical name, *Acanthus ilicifolius*, probably superseded in late works.

The leaf is exactly like that of the common English Holly, and is sometimes used as a substitute for it in Christmas decorations, the berries being made up for the purpose of red beads cunningly tied on with wire. The flower is pale blue, rather conspicuous, with a superficial resemblance to that of a sweet pea. On embankments and

other spots, raised ever so little above the marshes, we find the Chikhli (*Salvadora indica*), which so much resembles its relation, *Salvadora persica*, that one is surprised to find, apparently, a characteristic desert plant in so damp a situation. The fruit is of a much deeper and duller colour than in *S. persica*. For most of the description of these trees I am indebted to a report by Mr. Ebdon, C.S.

As the estuaries near the sea, the salt marshes give way to clean sandy beaches in long bays, separated by promontories of trap-rock, and these beaches are generally backed by groves of cocoanut and other palms. The embouchure has almost always a steep and hilly shore on one side (usually the south), and on the other a wide flat strand prolonged into a dangerous bar. Those of Bankot and Chaul are good examples. The smaller rivers which rise in the coast-ranges that run parallel to the Ghâts are miniatures of the larger streams that I have described ; but several of them debouch in the central part of flat plains, as, for instance, at Alibag and Warsoli. The plain here seems to have been once the bed of one of the lakes referred to above, the outer margin of which is still indicated by a line of reefs, of which Kennery Island and the Chaul Kadu Rock are the most elevated points. Subsequent to the immersion of most of the lake-bed in the sea, much of it has been reclaimed by the formation of sand dunes, originally backed by lagoons which have gradually become salt marshes. At this point the industry of man has stepped in to aid nature, and the sand dunes have become cocoanut gardens ; while the marshes, embanked so as to keep out the sea tides and retain the silt washed down from the hills, have become, first, salt rice-lands, and afterwards, as the silt accumulates to above spring-tide levels, capable of growing the superior rices which cannot endure even brackish water.

Wherever these reclamations have been made in creeks and back-waters, the mangrove swamps are of the greatest importance as protecting the water side of the embankments and furnishing materials for the repair of breaches. On the open coast, where the mangroves cannot face the surf, this function is performed by sand dunes formed by wind and wave. The total area of these reclaimed lands is very great, and their formation has within historic times greatly changed the face of the Konkan waters, and must have seriously modified their population, especially the Avifauna.

To seaward, immediately north and south of Bombay, that is from Dharavi to the Chaul Kadu Reef, the group of reefs, banks, and

islands of which Salsette is the largest and Bombay the centre, cover a great number of sounds and inlets, mostly centring in Bombay Harbour. Many of these are fast disappearing before natural silt and artificial embankments, especially the group west of Salsette and that east of Hog Island and Karanja, both of which have been changed from islands to peninsulas within living memory. This has given rise to an idea that "the coast is rising;" but if by this phrase we understand an integral upheaval of the rocky sea-floor, there is no evidence to support the doctrine. And in places where the coast is directly exposed to the ocean alone, surveys made under my own orders show that no change has taken place for nearly 30 years, that is, since the first revenue survey.

The basaltic sea-floor, outside of the reefs and islands mentioned (and from the coast itself north and south of them), descends by gentle slopes, broken here and there by terraces, until at about 60 sea miles from the coast the "outer line of soundings" is marked by depths, inside the line, usually of less than 100 fathoms, and outside it in most cases of more than 200. This is a very rough description of a matter deserving a fuller and better notice; but for the purposes of this paper, the "outer line of soundings" may be described as marking a range of submarine "Ghâts" about 600 feet high, forming the western face of a plateau continuous with the flat parts of the coast and descending from it, by gentle slopes and small scarps, at the rate of about 10 feet to a nautical mile. We know little positively of its material, but are justified from its outlines and position in supposing this to be the Deccan trap, overlaid of course with marine deposits.

The Orders, Genera, and even Species of aquatic animals which pass from the salt to the fresh water are in places pretty numerous, and it is therefore convenient to take the whole area together in noticing them.

The highest aquatic mammal of the Konkan is the Otter, which inhabits all the creeks and streams and occasionally visits the sea, but is not very common, and being a nocturnal beast and very shy is seldom seen. It breeds in the hot weather.

After it come the cetaceans, of which we know but little. The Indian Rorqual is known occasionally to visit the coast, and there may be other large species. However, in a considerable experience of the Konkan, I never saw a Whale spout in sight of shore but once. It would be interesting if the experience of some of the officers of the B. I. S. N. Company regarding this matter could be made

available. I have had two heaps of bones of Whales which had been stranded south of Bombay. One must have been over 40 feet long and the other under 30, so far as could be guessed from the *dissecta membra*. The latter was distinguished by possessing flat intervertebral plates of bone, which I could not find in the former. Neither had teeth.

Besides these, I have at different times received single vertebrae of at least two Whales. The last and largest of them is in the Society's Museum, and must have drifted a long way. It shows clearly the marks of the peculiar spades used by whalers in stripping off the blubber before "trying it out" into oil. But no whalers fish within many hundred miles of Bombay.*

We have at least two Porpoises—one a true *Delphinus*, called by the natives "Gadha" (*i.e.*, Donkey), perhaps from his constant habit of kicking and frisking on the top of the water. There is a smaller one called "Bhulga," which is less common and is distinguished by having apparently *no back fin*. It keeps in shallow salt water; and I have not seen it frisk and play like the "Gadha."

I have never been able to get a specimen of either;† they often get into fishing-nets, but almost invariably tear their way out. Some years ago some gentlemen from Bombay tried to harpoon them in

* There are Whale fisheries about the Maldives and Seychelles. The likeliest large Whale on this coast is *Balænoptera indica*, the Indian Rorqual or Finback. I believe that a specimen in Bombay has been doubtfully identified as belonging to the allied genus *Physalus*. They have no teeth; only whalebone strainers. Right Whales (*Balænae*), which have similar strainers and no back fin, are extra-tropical animals and need not be looked for here; but the occurrence of a Sperm Whale or Cachalot (*Euphysetes simus*), with visible teeth in the lower jaw, concealed teeth in the upper, and a very small back fin, is possible, as of *Globicephalus indicus*, really a gigantic Dolphin, with a large back fin and visible teeth in both jaws.

† Since the text was written and sent in to press, I have received three specimens of the Bhulga, which has been identified as *Neomeris karachiensis*, and anjoin description, *viz.* old female, gravid; total length between perpendiculars, 4 feet 2 inches; maximum girth, 2 feet 7 inches; width of tail, 1 foot 3 inches; length of flipper, 9 inches; live weight, 60 lbs. avoirdupois; colour, leaden black, lighter below, especially on the breast; nose, chin, and interior of mouth dirty white.

No dorsal fin; but back behind the flippers flattened and hollowed out and carunculated; near the lumbar region edged with a slight salient angle, which may be taken to represent a rudimentary dorsal fin.

Mammæ 2, inguinal (of course), concealed in slit valves. No rostrum whatever. The profile rather reminds one of a Turtle's.

Teeth visible and numerous in both jaws (anxiety to preserve the specimens quickly prevented their being counted) in both adult and foetus. In the former they are well worn down, showing that it is an old animal.

Spiracle crescent-shaped, single, central, and far back. No water was expelled from it in "blowing" during several hours that I had the animal under observation in water over its depth. I should say here that I am well acquainted with the Rorquals and *Globicephalidae* in the wild state, and never saw either *spout water*. Their discharge is more like that of a starting locomotive steam-engine on a railway.

The contents of the stomach were many prawns (*palæmon*), mostly of large size, 3 to 5 inches long; three very small "bones" of sepias, the longest 2½ inches, and one pen of a squid (*loligo*) also very small. None showed any signs of dental action; they had apparently been swallowed whole. It is worth while to remark that the tongue of the "Bhulga," though distinct, is jaw-bound.

Mahim waters, but I believe failed. Two drifted fragments of skulls (from the Alibag Reefs) are in the Society's Museum. They appear to belong to different species.

Probably with a suitable steam-launch, and a combination of the rifle and harpoon, some very good sport could be had out of the "Sea-donkeys," which are extremely numerous and not very shy. This has been tried with success in the English Channel. The sportsmen referred to above used canoes; and I have tried to shoot them from a sailing boat, and (of course) believe I hit them. But I never bagged one. Of the Sirenia, sometimes called herbivorous cetaceans, *Halicornia dugong* may occur, as it has been reported from Canara; but our basaltic coasts are not rich enough in seaweed to feed it, so its appearance here is unlikely. It is sometimes called a "Seal;" but true Seals are seldom or never found between the tropics.

Of birds we have all those mentioned as found in the Deccan, and others more appropriate.

The chief of the marine raptorial birds here is the Grey-backed Sea-eagle, called in Maratha "Khakan" (*Halicetus leucogaster*). This bird is very common on the coast and creeks, and breeds here and there on trees. Sea-snakes seem to be the chief of his diet; but he catches a good many fish too, and is said to rob the Osprey of his plunder. This I have not seen myself, though the Osprey too is common here, both on the salt and fresh waters, nor have I seen the Sea-eagle touch carrion or strike birds. He does not resort here to the fresh waters; but the Osprey is seen on rivers and tanks as often as on the shore. The Brahminy Kite fishes a good deal on the surface of the fresh waters and creeks, seldom "out of harbour," and picks up carrion and crustacea on the shore; and the Paria Kite (*Milvus govinda*) frequents harbours.

Some naturalists believe in a "large Paria Kite" (*Milvus major*); and Mr. Hume has recorded specimens from the dunes of Upper Sind and Bombay Harbour which entitles him to a place here. To my own knowledge, there is in the forests of the Konkan a Kite answering to the description; but whether he be really a separate species, or merely an aristocrat among "Paria" Kites, I don't pretend to say. The superior size and gentlemanly appearance of this bird, both on the wing and in hand, are very marked. The so-called "Blue Kite," or Harrier (*Circus swainsoni*), and Marsh Harrier (*Circus aeruginosus*), the White-eyed Buzzard (*Buteo teesa*), and probably the Long-legged Buzzard (*Buteo ferax*), hunt

about rice-fields and the edges of swampy tanks and rivers for small birds, and probably for frogs; and so do both the Serpent-eagles (*Circaetus gallicus* and *Spilornis cheela*). I see that Lieutenant Barnes considers this last bird to be represented here by *Spilornis melanotis*; but I have shot many in the Konkan showing distinctly the marks which he insists on for *S. cheela*, viz., conspicuous ocellation and barring on the lower surface and breast.* It is a common bird in the Konkan jungles. As with many other Eagles, the young of the year remain for some time with the old birds, and one can often hear three or four of them calling to each other out of trees or on the wing. It has several notes: the commonest is "Qui-yu-kuh," sometimes "Ku-qui-yu-kuh," "Kou-we-you" (rather long and deep), or a sharp repeated shriek "Qui-qui-qui." The Brown Fish-owl (*Ketupa ceylonensis*) is known, but being a shy nocturnal bird is not often seen. I never got a specimen myself.

Swallows can hardly be called aquatic birds; but it is worth while to notice that the "Edible-nest Swiftlet" (*Collocalia unicolor*) breeds in our present region on the Vingorla Rocks; and specimens of the nests from that place are in our museum. The theory that the nests are built of sea-weed, which would be a more legitimate excuse for bringing the bird in here by the neck and heels, cannot unluckily be maintained any longer.

The region is rich in Kingfishers, for which its streams are well fitted, being mostly well provided with small fish and overhanging rocks and branches.

Halcyon leucocephalus, the large Brown-beaded Kingfisher, is rather common, and it is to me surprising that Lieutenant Barnes seems to think it a rare bird. It is tolerably familiar here; and I have often been able to watch one frequenting a tree near my tent for hours and days in succession. It has three notes at least. The common call is "Qui-yu-qui, Qui-yu, Qui-yu-qui." The alarm note is a harsh rattling laugh; and a wounded bird, when retrieved, has a "squawk" or "caw" very like that of a crow in the like case. *Halcyon smyrnensis* is common on all wooded torrents and tanks, and often at some distance from water, being largely insectivorous. The rare *Halcyon pileata* and *H. chloris* are both recorded by Mr. Vidal, and probably have escaped the notice of other observers, because on the wing, or at a distance, they were mistaken for *H. smyrnensis*. I have

* A Gujerat specimen shown at our September meeting as *S. cheela* has these markings, but less than many of my Konkan birds.

already mentioned *Ceyx tridactylus* as found in the Konkan-Ghât-Mátá; and as it is not essentially a bird of great elevations, we may be pretty sure that it exists on the better wooded streams below the Ghâts.

Alcedo bengalensis is very common on all fresh waters and on the coast, where it fishes in the pools left by the ebbing tide, and even in the surf on the reefs (not in heavy surf of course). One of these "long-shore" Kingfishers got to be very domestic in my verandah, which it frequently passed through on its way from the sea to a neighbouring tank, and would perch in for some time, taking refuge apparently from the violent rain-squalls which swept the coast. This was during the rains. The Blue Kingfishers seem to like sitting in the shade at midday in the hot weather; but *Halcyon smyrnensis* will also sit out on a look-out post, where he can see grasshoppers and the like. The Pied Kingfisher, on the contrary, seems to sit in the sun, because he likes it, and you may find him on every tank and open stream, on the creeks, and sometimes on the shore, where he is associated with *Alcedo bengalensis*.

The next set of water-frequenting birds are the Wagtails, which the natives call "Parit" (= "Washerman"). They are rather numerous, and as a class well known; and their technical distinctions of this and that feather would be out of place here. They are on all fresh waters, and occasionally on creeks or even on the sea-shore.

The Weaver-birds, or "Bhayas," are water-birds in one sense, namely, that they almost always build near water and, if possible, over it. We have three species. *Ploceus bhaya* is common in the region. *P. manyar*, the Striped Weaver-bird, is more frequent at its northern end, where it opens into the plains of Gujerat, this being essentially a bird of the open country and of waters with reedy banks. *P. bengalensis*, the Black-throated Weaver-bird, is here rare and local; it has the same habits as *P. manyar*. Neither of the two last is as lively and interesting as the intelligent "Bhaya."

Of the Plovers proper, we have none of the Coursers, essentially moorland birds; nor, I think, any Swallow Plovers. The Grey Plover (*Squatarola helvetica*) is said to occur "all along the seaboard." I have never got it here myself, nor have I seen here, nor do I expect to see the Indian Golden Plover (*Charadrius fulvus*). If anywhere, these birds will be found on the occasional wide stretches of grass-land near the sea, such as the commons of the Alibag Taluka. Mr. Vidal

has recorded the occurrence of the rare Caspian Plover (*Ægialitis asiatica*) ; and Lieutenant Barnes gives *Æ. geoffroyi*, *mongola*, and *cantiana* as coast-birds, and *Æ. dubia* and *minuta* generally for the Presidency. The last ought to be the *dubia*. It is a very dubious species indeed.

The European Lapwing is extra-tropical, and its nearest allies, the *Chettusiæ*, are rare cold-weather visitors here. Their place is taken by the Red-and-yellow-wattled Lapwings, or "Did-ye-do-its" (*Lobivanellus goensis* and *Sarciophorus bilobus*). The first is on every stream : the latter is less aquatic and rarer. The Stone-plovers *Esacus recurvirostris* and *Edicnemus scolopax* are not very common. The former deserves its name, frequenting sheet-rock and shingle in the beds of rivers and creeks (preferring fresh water). The latter ought to be called the Grass-plover, as its favourite quarters are in open grass-lands, and it is so independent of water as hardly to deserve a place here. It is the "Bastard Florican" of sportsmen, and does really seem by its habits to mark the connection between the Bustards and the Plovers, birds not widely separated by anatomical characters.

Of the *Hæmantopodidæ*, or Pied Sea-plovers, the Turnstone and Crab-plover may be looked for, and I think I have seen the latter. The Oyster-catcher is a permanent resident, and probably breeds here in small numbers.

There are absolutely no Wild Cranes in the region, probably because there are few cold-weather crops.

The Common and Pin-tailed Snipe are frequent cold-weather visitors, though the snipe-shooting of the Konkan is a poor affair to a man of Sind or Gujerat. The Pin-tailed appears to increase in number southward, which must be only an appearance, as both are undoubtedly immigrants from the north. The Jacksnipe is less common here than above Ghât ; they are all usually known as "Ishnáp;" but the true Maratha name is "Shishi." The Painted Snipe is a permanent resident, and breeds here in the rains, but has a curious habit of shifting its quarters in May, in small "wisps" of five to ten individuals, who are very careless of cover, perhaps because there is so little left them that they cannot afford to be particular.

Like the resident Ducks, the Painted Snipe is at this season fittest for the table, and no doubt for the same reasons as given in my last paper.

The Curlew remains on the coast all the year round ; but its little brother, the Whimbrel, seems to be only a cold-weather visitor, and

is not so often seen, although the flocks are larger than those of Curlews. I have not myself seen the "Curlew-stint" on this coast. The genus (*Tringa*) seems to be chiefly represented by the little Stint (*T. minuta*), which appears in considerable numbers in the cold-weather. The Sand-pipers (*Actitis glareola*, *A. ochropus*, and *A. hypoleukos*) are common at the same season; the last less so than the two first. The Greenshank is common, and stays till April. The Redshank comes in smaller numbers and for a shorter winter visit. The Spotted Redshank, if it occurs at all, is rare; but the Little Greenshank is common throughout the winter, affecting fresh water and creeks rather than the sea-shore. The Stint is common on tanks, rivers, and creeks. This bird and the Greenshank sometimes figure on butlers' bills as "*Woodykak*," for which they are very fair deputies. I have not seen the Avocet here. Most of the birds mentioned above go into the bag as "Snippets," or are contemptuously let off, which is a mistake in the case of most of them (unless Snipe happen to be plentiful), as they are good eating and quite as hard to kill on the wing as Snipe. Certain *shikaris* indeed include in their bags of "Snipe" pretty nearly everything that has a tolerably long beak. In one case I saw with mine eyes the murder of a Paddy-bird for the bag as a "Snipe" or "Plover;" and indeed unless the term were pretty elastic, there would be no room round Bombay Harbour for the numerous sportsmen of the city. The firing there all Sunday morning in the cold-weather is enough to make one think the country up in arms.

The Bronze-winged Jacana is common wherever there are weedy tanks. Its ally, the Water-pheasant (*Hydrophasianus chirurgus*—why *chirurgus*?) is much less so. I once saw one perched on a rock on the sea-shore. When disturbed, it flew off over the water to an island; but what brought it in such a place I cannot imagine. The Purple Coot is usually found associated with, or in the neighbourhood of, the two last birds, but is rare here. The Bald Coot is not very common. The tanks of the Konkan are too small for it. The White-breasted Water-hen is very common on the banks of rivers and in gardens, often at some distance from water. I have not seen the English Water-hen here. Water-rails and Crakes are not unfrequently shot amongst Snipe and Quail, especially by "griffins." I have no note of species observed.

Of Storks, the Great Adjutant and Jabiru (*Mycteria australis*) are rare. I have seen the former once below Ghât, and once in the

Konkan-Ghát-Mátá, to the best of my memory, and the latter only once below Ghat. The Black and the White (European) Stork I never saw in the Konkan at all. Here, as in the Deccan, the White-necked Stork (*Ciconia leucocephala*) takes the place and name of the former, and is pretty common.

The Herons are the same as in the Deccan, but far more numerous in individuals, especially in the creeks and salt marshes. Only the Purple or Grass Heron is uncommon, as there are few extensive waters with grassy banks. Most of them frequent the sea-shore : the exceptions are the Night Heron and (naturally) the Cattle Egret. Natives shoot the White Egrets (*Herodias*) a good deal for their dorsal plumes, which are marketable in Bombay. I do not think that any true Bittern occurs in the Konkan.

The Ibises, however, are pretty well represented by the Pelican Ibis and White Ibis ; the former on fresh waters ; the latter usually on the estuaries, where it associates with Curlews. The Shell Ibis is locally common on fresh water only. The Black Ibis (*Geronticus papillosus*) is rather rare ; and I have not seen the Glossy Ibis (*Falcinellus igneus*) at all. "Korle" is the Maratha name for both Ibises and Curlews.

The Spoonbill is decidedly rare. It is a bird of opener waters than we have here, where even the creeks are fringed (generally) with rock or mangrove. Now the Spoonbill does not like either rocks or trees. With it terminates the list of Fowl merely associated with water, and begins that of the Waterfowl proper. It leads up, in fact, to the Flamingo. In our last number I gave reasons for treating this bird as a Duck, and need not repeat them here. It is a migrant on the Konkan coast, but remains till June, in which month I have seen a flock flying north. I am not personally acquainted with the species or variety called by some writers *Phaenicopterus minor*.

No Swans and no true Wild Geese occur in the Konkan. The Black-backed Goose and its duodecimo edition, the so-called Cotton-teal (*Sarkidiornis melanonotus* and *Nettapus coromandelicus*), are found throughout the region, though both are rather uncommon. The climate suits them ; but the waters do not. They do not like salt water ; and the tanks and river-pools are not big enough for them ; but both may breed in favoured spots.

Of the next group of Ducks, the *Tadorninae*, the Lesser Whistling-teal is found ; but it is not common ; and I have only seen it myself in the cold-weather. I was much surprised to find a small flock

established on a rocky estuary, having always associated this bird, in my own mind, with grass and fresh-water. I have not found the Larger Whistling-teal here at all.

The "Brahminy" Duck is not common, and is even excluded from the Tanna District by the *Bombay Gazetteer*.

I have however once seen a pair in Bombay Harbour. Its relative, the true Shieldrake, has not yet been reported, I think, from the Konkan. We have the Shoveller, which is here a wild bird of respectable habits, and accordingly fit for the table. The European Mallard is unknown; and its representative, the Spot-billed Duck, is not very common, nor, as far as my observation goes, a permanent resident. It is however extremely likely that when the Tansa Lake is filled, this and several other Indian Ducks will breed there. I hope that the Engineers will provide that lake with an island or two; and that the Municipality will make it a sanctuary as regards birds. The shooting about Bombay would certainly be much improved by such a course, as Ducks like to make a large sheet of water their head-quarters, but will forage every day at considerable distances from home. The Gadwall occurs in the cold-weather, not in great numbers; and the same is the case with the Pin-tailed Duck and Widgeon. The Common and Blue-winged Teal occur pretty frequently, especially the latter. The Red-crested and Red-headed Pochards are rare; but the White-eyed Pochard is the most plentiful Duck on the coast and on creeks and tanks near the sea. I have not myself shot the Black-and-white-tufted Pochard here; but I believe that I have seen it on the creeks, which are well suited to it.

Taking them altogether, the waters of the Konkan do not furnish good Duck-shooting. The birds mostly spend the day in the middle of the creeks, or on islands, or on the muddy and narrow margin between the water and the mangroves, where they are pretty safe that nothing can see or get at them from the shore-side at all, and nothing can surprise them from the water-side.

The deadliest way of killing them, no doubt, is to find out a feeding-ground in the salt marshes and lie in ambush ("flight-shooting," in short). But the pleasantest way of shooting on a creek is to take a boat or canoe capable of towing a small dinghy with one man in it, and run up or down the creek under easy sail and with the tide. The gunner is best placed in the bow of the boat, unless the sails be such as to interfere with him there. One man stands to each sail,

and one to the painter of the dinghy, in which the "retriever" sits ready with his paddle or bamboo pole. Either of these is better than sculls, as the latter involve his rowing with his back to the game, or "backing water," and both manœuvres are inconvenient if he has to pursue a winged Duck.

Birds are not so much alarmed by the gliding motion of a boat under sail as by the more demonstrative processes of rowing or paddling, and will often give a sailing boat a shot. As the bird falls, the sail-trimmers instantly lower or brail up the sails, the man at the painter casts off the dinghy, and the "retriever" starts for his bird; while the helmsman brings his boat to the wind, or throws out a little grapnel or anchor; a stone does well enough. In the smooth creeks these manœuvres are not dangerous. When the retriever has got his bird (for which purpose he has, or should have, a light landing net) he rejoins the admiral, and the proceedings go on *da capo*. This is by no means a very killing way of shooting; but fair bags can be made, *plus* the poetry of motion in what is usually good scenery, and sometimes very beautiful indeed. Sometimes one should land from the boat, and employ her to divert the attention of the birds from a stalk, and this gives variety. The boat too enables one to indulge in a certain amount of comfort, and even, if necessary, to have books with one, to say nothing of fishing-tackle and belly-timber; and birds intended for preservation can be properly stowed away in a box or basket, or taken in hand at once. The rest of our water-birds are unfit for the table, or at least commonly thought to be. The first of them is the Dabchick, which is a permanent resident on tanks. It can however fly from one tank to another, and moves about a good deal more than it gets credit for, as it travels at night, probably for fear of Hawks and Eagles.

A "Mother Carey's Chicken" (*Oceanitis oceanica*) is known but rare. I do not know where it breeds; but on one occasion I noticed great crowds of various Sea-fowl near the Arabian Coast east of Aden; and the cliffs of that coast may well be the breeding-ground for some of our species. I don't know of any on our own coast.

I once got a live Shearwater, probably *Puffinus persicus*, which is in the Society's Museum. It was a storm-driven bird; and I have seen only one other in this region. I have not seen any Skua-gull here at all.

Indeed the poverty of this coast in Water-fowl is very remarkable to a fisherman trained on the Atlantic. Lieutenant Barnes speaks of

the Lesser Herring-gull as occurring "in immense numbers all along the coast;" but I have never seen a really large flock of these birds here myself. Probably he referred more particularly to the Sind Coast. The Black-headed, Brown-headed, and Laughing Gulls occur, especially in the winter; the two latter go far up the creeks, and may sometimes be seen over rivers and tanks. The Sooty-gull (*Larus hemprichi*) occurs, but is not common. *Larus gelastes*, the Rosy-gull, may be looked for. I have not seen it here as yet.

Gulls indeed are much less numerous on this coast than the next group, the Terns. On account of the comparatively small area of permanent fresh water in the Konkan, the Marsh and River Terns are not very numerous; but we have in moderate numbers the Caspian, Gull-billed, and Whiskered Terns; and probably the large River Tern and Javan or Black-bellied Tern will be found hereafter, at least as stragglers.

A small Tern very common on creeks appears to be *Sterna minuta*; it may be Hume's *Sterna saundersi*, but I have a dislike to shooting these birds (which are very confiding, and often attach themselves to a boat and follow it for many hours), and cannot be sure of species not closely examined.

Thalasseus cristatus and *bengalensis* are common.

The Sooty-tern occurs, but is not very common. On inspecting after the south-west monsoon a beacon-tower on an exposed reef, I found in its chamber the remains, apparently, of a Sooty-tern, entangled with those of a banded Sea-snake about 20 inches long. It must be supposed that the Tern had caught the snake and carried him there to eat him, but been bitten by his victim, who was probably too much injured by the bird's beak to leave the spot. At the best, Sea-snakes are very slow movers out of water. I do not think however that our Gulls and Terns habitually attack Sea-snakes. Perhaps *Larus ichthyætus* may. Some of the large European Gulls would eat a baby if they found him unprotected. It was also very singular that the Tern should have carried his prey *inside* the tower. I can only account for the whole affair by supposing the bird was desperate from hunger in foul-weather.

The curious Skimmer (*Rhynchops*) does not occur here.

A white tropic-bird, or "Boatswain-bird," is not uncommon. It is probably *Phaeton candidus* or *Phaeton ætherius*. It gets the name of "Boatswain" from the fancied resemblance of its long pointed

tail to a marlinspike, which (for the benefit of any reader that does not know) is a long thick iron pin, with a hole in one end, used for unlaying ropes. It is the characteristic tool of the boatswain, who is immediately in charge of all rigging; and the proper place to carry it is in the back band of the trowsers.

We have one Gannet, or Booby, which is probably *Sula cyanops*. It is not Jerdon's White Booby (*S. piscator*), which has the bill and feet red, while in our bird the bill is slate-coloured, blackish towards the base, and the feet dull slate colour. It is a good deal to be regretted that recent naturalists have appropriated Jerdon's English name to a bird for which he certainly did not mean it, the more so because he prided himself on his system of English names, and took a great deal of trouble to make them clear and intelligible to everybody. A few birds of the present species are driven on to the coast every year by south-westerly gales, and are generally easily captured by hand. The present writer has sent specimens to the Society's and Victoria Museums, so there need be no doubt about the bird.

I don't think any Pelican occurs in the Konkan. If any, the grey species may be looked for, and there would be nothing surprising in its occurrence; but the fresh-waters of the region are rather too small for it; and it does not seem to like sea water. The Large Cormorant does not, I think, occur; and the Lesser Cormorant (*Graculus sinensis*) is not common. The Little Cormorant and Snake-bird are extremely common.

The highest reptiles of these waters are the Terrapins and Fresh-water Turtles, which do not differ from those of the Deccan. I have never got their eggs;* but they seem to breed in the rains, as the young are very plentiful in October and November.

Two species of Sea-turtles are common on the coast. They are easily separated from those of the fresh-waters by having flippers instead of feet, and never showing more than two claws on a flipper, often only one.

The first is the Indian Green Turtle, *Chelonia virgata*, closely related to the Atlantic *Chelonia viridis*. The name I have adopted is sanctioned by its use in Dr. Gunther's "Reptiles of British India," and it is convenient to follow a standard work. It has thirteen shields of

* Since the text was written I obtained eggs of a Fresh-water Turtle (*Trionyx javanicus*) by dissection. They are almost spherical, cream-white, with a hard calcareous shell, about 25 in number. These Turtles, therefore, follow the Tortoises rather than the Sea-turtles in the matter of eggs.

tortoise-shell on the back, of a dull greenish-black colour ; but the surface is always covered with little chips coming off, which give it a grey appearance when dry. When polished, it shows very pretty markings. These shields are no thicker than a sheet of thick note-paper, ; but the bony plates below them are sometimes as much as a quarter of an inch thick on the sides and half an inch on the shoulders.

The largest I ever got on this coast measured 5 feet between perpendiculars, with his head as far in as he could withdraw it. The greatest total length may be taken at 5 feet 6 inches, and the live weight was 260lbs. avoirdupois. No doubt larger specimens occur ; but from the information of a friend who had paid special attention to Turtles at the Nicobars (where they abound), I find that the average there is much the same as here ; and anything over 160lbs. is a good Turtle. They are frequently caught in nets ; and the females are surprised at night when laying their eggs. For this purpose they prefer midnight and a spring high-tide, but are not strictly bound to time or tide ; and I should not be surprised if they were found to lay in broad daylight on uninhabited coasts. They crawl up above high water-mark, often on grassy sand dunes several feet above it, and dig a hole, which is usually about 15 inches deep. The eggs, about 125 (but often far more numerous), are laid in the hole and covered with sand. They are at first of a very pale yellowish-pink colour, rather less than a racket-ball ; and each egg has a crease in it. As development goes on, this disappears ; the parchment-like skin of the egg becomes tight, and perhaps even stretches a little ; at any rate the whole egg looks larger, and a dark blue stain appears on one side, the rest of the egg acquiring a dull white colour.

The Natives say that the old Turtle knows when the eggs will hatch, and then swims opposite the nest at high-water, and *whistles!* to the young, who, in obedience to the signal, tumble up out of the sand, and scuttle down to the water. The period of hatching varies greatly. The Natives put it at 3 weeks ; and I know from experiment that this is sometimes enough. But I have now six clutches under observation, of which two are 42 days old and one 36 days. It depends upon the position and weather ; shade and low temperatures evidently retard the hatching. Both wet and drought can prevent it altogether ; the sand must be damp enough to keep the eggs cool, but well drained and, if possible, exposed to the full blaze of the sun. I keep most of the eggs in baskets, full of sand, set on bricks to secure drainage. The young are amusing creatures, very black and very

active. If turned on their backs, they can right themselves like the Terrapins and Mud-turtles, and unlike their own parents. They are apparently omnivorous. At the time Dr. Gunther wrote, this species was supposed to live entirely on *algæ*; but if it could not do without these, there would be very few Green Turtles on this coast. The breeding goes on all the year round, chiefly, perhaps, in the autumn and beginning of the cold-weather. The eggs are just tolerable fried, or in an omelette.

The flesh resembles that of the "Alderman's Turtle" (*Chelonia viridis*), and is, of course, used like it for soup and cutlets; but about the best thing to make of it is a kabob curry. It is said occasionally to be poisonous. If this is really the case, the cause is probably in some disease of the animal, and not in any natural changes; for the most likely of these, exhaustion after laying eggs, certainly does not make the flesh of this Turtle unwholesome. The females, however, are naturally thin and poor at this period; and the best meat is that of Turtles caught at sea, barren or not, far advanced in pregnancy, or males. The latter, I think, do not come ashore at all.

Our second Sea-turtle is the so-called Indian Logger-head (*Carrana olivacea*). It is not logger-headed nor olive-coloured at all, but has rather a fine profile—for a Turtle, and a good complexion, showing regular "tortoise-shell" colourings when wet. It seldom reaches 3 feet long; it is less common than the Green Turtle; and I have never got the eggs. It is reputed carnivorous; and by some its flesh is thought inferior to that of the Green Turtle; but I cannot myself make out any difference in taste.

Two other Turtles may be found here; but I do not think that they are yet reported. The first is the Indian Hawk-bill or Tortoise-shell Turtle, which alone has shields thick enough to make combs of. These overlap each other like the scales of a fish, whence the name (*Caretta squamata*). The other is the giant of the tribe, the Leather-backed Turtle (*Dermatochelys coriacea*), which has no tortoise-shell at all, but a thick skin laid over a ridge-and-furrow arrangement of bony plates.

The only Crocodile here is *C. Palustris*. I know that some specimens from Tulsi Lake have been exhibited at the Society's Rooms as *C. porosus*; but they all had the unmistakeable shields on the nape of the neck characteristic of the former species.

This is only locally abundant; most so in the Kál River in the *Mangam* Taluka of Kolaba. The fact is the fresh-waters and their

fish are not big enough for it ; and it is only an occasional visitor to the estuaries, and very rare in the sea.

The Crocodile-shooting in the Kál is really good.

At Ashtami, on the estuary of the beautiful Kundlika River, there is a small double-barrelled tank, containing innumerable frogs and water-beetles, a very few tiny fish, and perhaps a score of Crocodiles over 5 feet long, besides youngsters, which keep in the shallow water for fear of being eaten by their parents. They are ludicrously tame. The oldest inhabitant had never heard of their hurting any one ; and one could see them watching women washing clothes, and mere babies paddling in the shallow water, without, apparently, a thought of mischief. One over 6 feet long crawled out within pistol-shot of my tent, and was shot by candle-light. He had nothing in his stomach but water-beetles, may be a gallon of them, and flint-stones swallowed, I suppose, to aid digestion. A few days after a friend of mine (also a member of this Society) wounded the patriarch of the tanks. A gang of life-boatmen, attached during the fine season to my own and another private boat, dived and literally harnessed him, and dragged him ashore, roaring, snapping, and lashing the "scaly horror of his tail" like the old dragon. But on dissection we found the same water-beetles, *plus* two crows which I had been using for bait in a vain endeavour to hook him. This brute was 10 feet 2 inches long and over-pulled my spring balance at 300lbs. I had watched them catching something all day for ten days, and thought it must be frogs or tadpoles. The idea of such brutes living entirely on water-beetles is new to me ; and I would like to know if any member has seen the like. Their teeth were quite black, whether by reason of the water-beetle diet or not I cannot say. Usually they are white, with brown stains.

Varanus dracæna, the Ghorpur, is very common, and eaten by many castes. The name of Water-lizard is, however, misapplied to it. In its habits it is a Land-lizard, which swims well, as many Land-snakes do ; and can even dive well, which they generally cannot do. But it is quite independent of the water, and is often found miles from anything more than a well or puddle in a nullah.

Varanus lunatus, the Banded Ghorpur, may exist here. Young Ghorpurs are all banded ; but this reptile is described as having 105 cross series of shields between the gular fold and the loin, as against 90 in the original Ghorpur. The Great *Hydrosauri* are not found.

As for the Fresh-water Snakes proper (the *Homalopsidæ*), they are not, as a family, numerous here. This may be surprising to people accustomed to think of the Konkan as a damp and marshy country ; but the truth is that that description only applies to it for five months of the year. From November to May inclusive most of it is a very waterless country indeed to the great suffering of the people.

An estuarine species (*Cerberus rhynchops*) literally swarms in the creeks. As you sail up them you see a head popped up here and one there, and as instantly withdrawn, till you wonder what they all find to eat. It is an active reptile ashore as afloat, and the native name is *Udhan* (=“ the Jumper”) from its peculiar way of springing forward. The Spotted Water-snake (*Tropidonotus quincunciatus*), which is not a true Water-snake but amphibious, derives from that nature a great advantage here and quite crowds out the *Homalopsidæ*. I strongly suspect that it fights, and even eats, them, but cannot propose to prove that just yet.

It has several varieties in colour, varying apparently with the colour and light of the water ; and ashore, it uses the same curious springing motion as the *Udhan*. It occasionally visits estuaries ; and I have taken small salt-water fish (*arius*) from the stomachs of individuals taken in nets in such places. So it is not a mere drift of the land-floods, but can forage in salt water. So does *T. punctulatus*.

These Fresh-water and Amphibious Snakes are not poisonous. The next family, the Sea-snakes, are all poisonous, though none of them can be called “deadly” in the same sense as the Cobra and Chain-viper, for a fair bite of whom there is no cure. Moreover, their fangs are very short, and a little clothing would guard a man from them. It is an additional reason for always wearing clothes when swimming in tropical waters, in some of which these reptiles swarm, if protection from the sun and from cold on landing be not enough to induce any reasonable man to swim in flannels. Except in racing, or at the moment of leaving the water, these are really no incumbrance at all, floating lighter than the human body.

Two genera of Sea-snakes, *Platurus* and *Aipysurus*, have the same classes of scales as Land and Fresh-water Snakes ; that is, small scales above, and large ventral shields below, the latter acting as feet. I believe that neither genus is represented on our coast. If anywhere, they should be looked for on shores and in marshes, for we may be quite sure that the ventral shields exist in them, as in terrestrial

Snakes and the Homalopsidæ, to enable them to move on land, or at least on mud. They are, in fact, Shore-snakes rather than Sea-snakes, though, like the Fresh-water Snakes, their nostrils are placed high on the snout, and, like the Sea-snakes proper, they have, in addition to this, the ventral region more or less compressed; and the tail flattened out into an oar, to be used as the single and sculling oar is in a merchantman's dingy. This motion however is not in any Water-snake or in any Land-snake (swimming for the time) confined to the tail. The undulation of the whole body propels it forward, and in some of the most essentially marine species the flat tail, properly so called, is insignificant; and the abdominal region does most of the propulsion. Snakes, in fact, move in water, as on land, by undulation. Only in the former medium, their best purchase is on their two sides. On shore, it is naturally on the belly. True Sea-snakes, stranded, are even more helpless than fish in a similar position, for the latter do then use their lateral fins on the bottom as legs, and often regain deep water in that way.

But the Sea-snakes, with their lax bellies and small scales, lie helpless. They wriggle truly, but on one spot, like a rocking-horse; and they generally remain till a passing man squashes their heads, or a bird of prey carries them off. The Grey Sea-eagle is a great hand at this, and always goes once up and down his beat on the coast, every tide, with a view to tide-falls of the sort. These Sea-snakes without ventral shields, mostly belonging to the genus *Hydrophis*, are of a great many species, and offer considerable variety in form. I might almost say that amongst them there are analogues of most venomous Land-snakes. With a single exception, however, they are of very similar colouring, banded black and white.

The bands take different shades. In some they almost merge in a general dull grey; in some the light favouring, you can call them purple and yellow. They are continuous round the body or forked, a single band on the right side meeting two from the left, or those of each side alternate; but the type is general.

There are exceptions to it. One is a very widely distributed Snake (*Pelamis bicolor*), which has several varieties. That commonest here is, when young, velvet black above, on the abdomen golden yellow, and on the flattened tail handsomely mottled black and white above and below. As it ages, apparently, these brilliant colours fade to a dirty olive on the back, and equally dull white below, all over; but one specimen which I have sent to the Society's Museum seems to

have retained its colours to maturity. Another is the new *Hydrophis phipsoni*, striped black, white, or grey.

The *Pelamis* is the only Sea-snake that justifies the Ancient Mariner's description. The rest are loathsome reptiles. In many hundred specimens I have not witnessed the ferocity ascribed to them by Dr. Gunther. In one case only I saw one bite itself, apparently with no ill effects, though the species (a *Hydrophis*) was certainly venomous. They are held in great contempt by the fishermen, though these well know their poisonous qualities. On one occasion, being in the water with half-a-dozen naked men, I saw a *Hydrophis*, 4 feet long, swim towards us, and called to a man who had a bamboo to kill it for fear of accident. He did not hear me; but a naked man, who did, picked up the reptile in the most unconcerned way, and chucked it on to the sand, where it lay helpless.

Pelamis is much more active both afloat and ashore, and gets more respect accordingly.

My fishermen call all Sea-snakes "Kilis" in Maratha.

For the Great Sea-serpent, we know nothing of him here, except that he cannot be of any type of Sea-snake known to us. For, if he were Platanoid with ventral shields, he would surely come ashore to exercise them; and if he were a true clumsy *Hydrophis* without ventral shields, he would as certainly get cast ashore sometimes, as that tribe and the whales do. Or at least an odd bone would drift to us, as my bone of the "whaled" whale did from unknown, but certainly very distant, regions, with the cuts of the blubber-spades on it. The bones of Sea-snakes float easily.

Our Sea-serpents do not often reach 6 feet long, but we read of their attaining 10 feet.

It does not follow of course that there cannot be a Great Sea-serpent of a totally different type, possibly far more saurian or more fish-like.

KESWAL.

BIRD-NESTING ON THE GHATS.

BY MR. J. DAVIDSON, C.S.

I HAD paid a short visit to the Kondabhari Ghât in August 1885, and the beauty of the place at that season, and the number of birds evidently breeding there, made me determine to go there this year at an earlier period, when I would find fewer young birds and more eggs.

My transfer however to another district seemed at first to make this impossible. Thanks however to good early rain, the population were too much taken up with their farming to quarrel with their neighbours, and I found I could get away for a week without any great inconvenience to any one.

It was therefore with a light heart that on the afternoon of Saturday, July 10th, I left my head-quarters on a week's casual leave *en route* to the Ghâts.

A rapid drive of some thirty odd miles brought me to Dhulia, the head-quarters of Khandesh, in time for dinner, and I was fortunate enough to escape without any rain, though the country near Dhulia was almost under water, and I could see heavy rain following me nearly all the way.

The crops were looking well as long as it was light enough to see them; but bird-life was not abundant, and all that I saw worthy of notice was a solitary Adjutant (*L. argalus*) accompanying some Grey Cliff-vultures in a banquet on a dead cow.

The Adjutant is never common here, and during the five or six years I have known these districts, I have not seen a dozen in all, and always single specimens, and that during the rains and cold-weather. The Adjutants in the east of India seem mostly to resort to Burmah for breeding, and breed there in October; but no one seems to have found out where the birds from Western India breed or when.

A little further on I saw a Roller (*C. indica*, not *C. garrula*). This was distinctly exceptional. During the cold-weather *indica* is very common everywhere in Khandesh and Nasik; but in the hot-weather it leaves the plains and breeds abundantly in the Satpuras and Ghâts, and at the beginning of the rains it appears to leave the district (plains and hills alike). From the beginning of June till the middle of August one hardly ever sees a Roller. About that date, *C. garrula* appears about Dhulia in some numbers and remains till October, in the beginning of which month and the end of September *C. indica* also returns. Sunday, the 11th, I spent in hospitable Dhulia, and the juvenile Bhil population as usual brought a variety of nests and eggs. These consisted of the usual common Dhulia birds—*Prinia* (*hodgsoni* or *gracilis*) and *Stewarti* (for the first two birds are one species), *Franklinia buchanani*, *Perierocotus peregrinus*, *Caprimulgus asiaticus*, *Drymœca inornata*, and *Sylvatica*, &c., &c., the only nest requiring special notice being one of *Volvocivora sykesi*. This pretty little Cuckoo Shrike is one of the earliest migrants in the rains, arriving

about the 8th of June, and breeding all along the scrub-jungles which stretch between the Nasik and Khandesh Collectorates. It appears particularly partial to the Angan forest, and, as far as I remember, all the many nests I have seen have been in forks of Angan trees. The nest is a pretty firm platform, composed of fine roots; and the eggs, which much resemble those of the Magpie Robin, are three in number.

The only bird I noticed specially at Dhulia was a single Alpine Swift (*C. melba*). In that most useful book Barnes's "Hand-book of Birds of Bombay," he states that this bird only occurs as a somewhat rare cold-weather visitant. In this I think he is mistaken, and that *C. melba* is a permanent resident in all parts of the country where there are high enough cliffs to afford safe breeding-places. I have been told that it breeds in Kanara at the Gairsoppa Falls; and I find in my note-book records of having seen it in Nasik and Khandesh in every month except October and November, so have no doubt that in this part of the country it is found throughout the year. Last May I saw flocks of hundreds flying into and out of fissures in the cliffs at Saptashring near Nasik, and though I could not get near the places, I have no doubt they were then preparing to breed. If they breed there, their presence anywhere within 200 miles would be nothing extraordinary, judging from the pace they fly at.

In the afternoon, about 4 o'clock, I left Dhulia and drove due west to Sakri, 33 miles, noticing on the road another Roller, apparently also *indica*. As it grew dark, occasionally a pair of Painted Sand-grouse passed across the road, and the cries of many Nightjars (mostly *asiaticus*, the others *monticolus*) were heard on every side. These birds are all common inhabitants of the scrub-jungle here which adjoined the road on each side.

I rose early on the morning of the 12th and by 8 o'clock had reached my destination, a rather dilapidated bungalow or tool-shed, belonging to the P. W. D., situated on the edge of the pass. On the road great numbers of males of a pure Yellow Moth (a *bombyx* apparently) were flying about. I had however no net with me, and did not attempt to catch them.

On arriving at Kondabhari I at once took a short stroll down the Ghât. The place is an admirable one for bird-nesting. The hills in the neighbourhood are very steep and slope down on the Nowapur Pergunnah, a sort of northern edition of the Dangs, with the same unhealthy climate and water. At this pass a small stream runs down and forms a valley seven miles long and in no place at all steep.

Government have constructed a very fair road down the valley, and as the hills on both sides are densely wooded, it is both a capital place for birds and easily worked.

I wandered down the nullah for a mile or so and found lots of birds; but nests were few and far between, and when I got back, about 11 or 12, o'clock, all I had found were some dozen of the beautiful hanging nests of *Zosterops palpebrosa*. Most of these were empty; but three or four contained young of various sizes, and two had each four eggs—in one case fresh, in the other unblowable. The nests were in every case suspended over the river (then dry), and varied in height from the ground from 7 to 20 feet. I also found four nests of *Myagra azurea*—one with a fresh egg, which I left, and the rest either empty and old or with big young. This bird is very common on this Ghât, and makes its nest, generally on an "Umar" tree. It is a very beautiful structure—a deep cup, generally attached to the side of a single hanging twig. Its sides are beautifully ornamented with white nests of some spider, the pattern being so regular in some cases as to resemble lace-work. I noticed a single pair of *Muscipeta paradisi* in chesnut plumage. They are rare at this season here, and I watched them a long time but saw no signs of their breeding, and when I again visited the place a couple of days later they were gone.

In the evening I again went out and worked up the nullah. In the first few paces a pretty little Blue Robin (*C. tickelli*) darted from its nest. This was placed in a crevice of the bank, and might have been mistaken for one of our own familiar Robin Redbreasts. It contained three olive eggs, perfectly fresh. The Blue Robin is one of the commonest birds at this season along the Ghâts, and its pretty metallic song seems never to cease if you wander along any of the nullahs. Its nests, of which I found many, including four or five with eggs, were placed in hollows either in banks or in the roots of trees, and were composed of dead leaves, lined with fine roots, sometimes intertwined with hair. I had hardly packed these eggs in my box when one of the Bhil boys noticed a large rough nest on a bare tree close to the nullah. It was a difficult tree to climb, and the boy declared it was an old one, but was promptly sent up to make sure. He scrambled unwillingly up, and as his hand was touching the nest, and his tongue again pronouncing the antiquity of the structure, a short-tailed bluish bird darted out. This was a specimen of the beautiful Yellow-breasted Ground-thrush (*Pitta brachyura*), and the nest, which was a clumsy structure of fine twigs, lined with dead leaves, contained five

slightly-set eggs. They were almost round, of a beautiful China white, with dark magenta blotches and lines scattered over them.

A few hundred yards further on two similar nests were found—one empty, and one containing five fresh eggs. The stupid boy however broke one in bringing it down.

A heavy shower of rain now came on, and in the narrow gorge we were in it was too dark to see anything, and we were fairly driven in.

The morning of the 13th was fine, and I drove a couple of miles down the pass and searched all the jungles on the left side of the road downwards. Birds were numerous, and I obtained two nests each with four eggs of *C. tickelli*, two nests, with one and five eggs respectively, of *Pitta brachyura*, as well as two empty nests of the same bird, one of *Alcippe poiocephala* with three eggs, and one of *Myagra azurea*, also with three eggs, and one or two of *Zosterops palebroza*.

All these birds were noticed again and again, though *Alcippe poiocephala* is much commoner 50 or 60 miles further south. One of the Bhils also knocked over with a stone a fine specimen of the Rufous Scops Owl (*S. sunia*), if it is really distinct from *S. pennata*. It is a full grown male, and only measured 6.1 in length. I noticed many specimens of *Scops bakhamuna*, the Grey Scops Owl of this district and the Satpuras. They are however very much larger birds, measuring from 8 to 9 inches. The Rufous Owl I have only found in this Ghât and during the rains. The evening I devoted to endeavouring to watch specimens of *Parus nipalensis* and *Machlolophus aplonotus* to their nests. The former was very common; the latter scarcer. I watched both pairs and single birds; but in that thick green jungle I invariably lost sight of them in some thick tree, and whether they had entered a hole or merely flown on to another tree I am to this day no wiser: I certainly found no nests.

On the morning of the 14th I took a lot of Bhils and walked down the nullah, taking the same ground I had gone over on the Monday. This is really much the best part of the jungle, and I was disappointed at its barrenness. I took the eggs, now three in number, from the nest of *M. azurea*, and got also a couple of nests of *C. tickelli*. In one however the eggs were ready to hatch. I did not disturb them, and the other was only building. I also found a nest containing three nearly full-grown young and one addled egg of *G. cyanotis*. This Thrush is not common here, and this seems in this part of the country about its northern limit, and it is only a migrant, arriving in the rains; it is however common enough

along the ridge running eastward from the Ghâts immediately north of Nasik. Thrushes as a rule are very rare in Khandesh. I have only seen one specimen of *M. horsfieldi* and one of *M. nigropileæ*, while the former is fairly distributed, though rare, in the north of Nasik, 40 miles south of this, and the latter simply swarms along the Saptashring Range stretching from the Ghâts eastward; so much is this the case that in a week the patel of one village sent me in 70 eggs of this bird collected in one small hill.

I watched a pair of Jerdon's Green Bulbul (*Ph. jerdoni*) for a long time, but they had evidently not commenced to build, and I shot the cock. Last year I obtained nests with eggs in this same Ghât in August. I also shot a pair of Indian Cuckoos (*C. micropterus*), or, more strictly speaking, two specimens, for they were both cocks.

Every day I heard a clear note I could not make out; and finally I followed it up and shot these two birds in the act of calling. It is not very common, and this is the only place I have noticed it in Khandesh. All the time I was at the Ghât I never saw or heard the European Cuckoo (*Cuculus canorus*). This is a very similar bird, but the much narrower bars on the breast make it very easily identified. It passes through Dhulia in the early part of June, and in July is very common throughout the Satpuras, a dozen often being heard at one time. It returns again in September, and no doubt breeds abundantly in the interval. As the Satpuras are barely 50 miles north of these hills, it is strange none of the Cuckoos stop to breed here in the rains.

Coming back I got a nest with three eggs of *Leucocerca leucogaster*. This pretty little Fantail is very common on the Ghât; but its nests are difficult to find, and the bird was not rare enough to make me willing to waste time over it. I only noticed one pair of the larger kind (*Leucocerca aureola*), and that was well down the Ghât. It however is common on the plains above. I noticed one Honey Buzzard (*P. ptilorhynchus*); and the shrill cry of the Hawk-eagle (*L. cirrhatius*) was constantly heard. This bird is common here and in the Satpuras; but in the adjoining parts of Nasik I have never noticed a single specimen, and it is far too noisy to be passed over. In the evening the villagers brought me a number of Mynas' eggs. These must have been from second nests, as there were lots of young flying about. All were the common species (*A. tristis*). Indeed I have never seen a single specimen of the Blue-eyed Jungle-myna (*A. fuscus*) in Khandesh, though it is common on the hills immediately south of that district.

On the 15th I had determined to have a day in the jungles at

the foot of the Ghât, and had sent the Bhil boys down the night before. The morning was however very wet, and it was past eight before I started. It was still wetter when I reached my destination, and I was glad to take refuge in a dharamshalla. About half-past ten it looked a little clearer and I ventured out, and by twelve it was quite fine. Everything was however soaking wet, and naturally I got very little. I found one nest of *Dumetia albugularis* with four fresh eggs. This bird I found in great numbers last year; but it was much scarcer this year, and I only got one other nest with hard-set eggs. The nests are placed on the ground, and are quite round, composed of long dry grass, the entrance being at the side. With the exception of a nest, with one egg, of *Alcippe poiocephala*, all the nests I found on this occasion were of common birds, and there were fewer birds and nests at the foot of the Ghât than along the sides of the nullah higher up.

The 16th was my last day, and I walked along the road for a couple of miles and then took the other side of the valley. I twice heard the mournful wail of a Ground-thrush. The bird's cry in the breeding season resembles that of a young Spotted-owl, and no one would ever dream it was the cry of a Thrush. I found the nest of one pair, but the eggs were not yet laid. In the other case I could find no nest, though the birds kept flying round and round me, and I think I examined every possible tree. The neighbourhood of this second nest (for there must have been one) was a very good place for nests. Within 100 yards I saw a brood of *Buchanga caerulea* just able to fly, and also one of *Oriolus melanocephalus*, while on an adjoining tree there was another nest of this Oriole with two slightly-set eggs. It was a very deep cup on the end of a thin branch, and though in cutting the branch to get at the nest it got turned at right angles to its proper position, the eggs were uninjured. I do not think this nest belonged to the same pair as that which had young ones flying.

These Orioles are very common here, and I found four nests: one was new and empty; from another the birds had just flown; while the remaining one contained one fresh egg. The bird would no doubt have laid more; but to get at the nest I had to cut the branch off, and it was only then I discovered that only one egg had been laid.

On the very next tree to the one with this bird's nest was an empty Thrush's, and 20 yards off a nest of the Common Ghât-babbler (*M. malabaricus*). This bird never seems to leave the jungles, and as soon as cultivation begins on the top of the Ghât is replaced by *Argya malcolmi*. The nest in question contained one fully-fledged young Hawk-

cuckoo (*Hierococcyx varius*), and there were *three* old Babblers in attendance. Nothing could induce the Cuckoo to leave the nest; and finally the boy threw nest and all down and it still held on with its claws and bit at my finger. *H. varius* is very common in the valley and on the hills above it, and its shrill cry "Pu-pe-ha," "pu-pe-ha," re-echoes from every hill, and not one Babbler's nest brought to me was without one of the round eggs of this bird. In each case the embryo Cuckoo was much further advanced than the Babblers; so it seems certain that the Cuckoo lays its egg before the Babbler does, or that its period of incubation is less. Probably both are the case, as I remember once starting a Hawk-cuckoo out of a small bush and finding in it a nest of *M. malabaricus* with a fresh Cuckoo's egg, but no Babblers' eggs. I have little doubt the bird I disturbed had just laid this egg; but as *Coccytes jacobinus*, which lays very similar eggs, is common in the Satpuras where this occurred I cannot be absolutely sure. During this visit to Kondabhari I neither saw nor heard *Coccytes jacobinus*, so am sure that the Cuckoo's eggs I obtained all belonged to *H. varius*.

A pair of *Graculus macei* was also apparently breeding near this place. I could not however discover the nest, though I watched for a long time. I found a nest with two young in September last near the same place; but in thick jungle it is easy to overlook a nest placed high up in a fork and of exactly the same colour as the bark.

On my return to the bungalow I found, among other eggs collected for me, two nests, each containing five eggs, of *D. sylvatica* and *Cisticola cursitans*. The former is moderately common both on the Ghât and in the Maidan above, but the latter never seems to enter the high grass and jungle of the valley.

Afterwards I had to leave and drive back to Sakri. On the whole I found much fewer birds than I expected; but of course no migratory birds had arrived, and few young birds were flying. The only mammal I saw was a Hare. There were fresh tracks of two Panthers and a Hyena and a few four-horned Antelope, but I never came across any of the animals themselves.

Moths were common, but Butterflies were few. Of the *Papilionidae*, the only one really common was *Eratonius*. I noticed a few specimens of *Polites*, *Agamemnon*, and *Nomius*: the first two were fresh from the chrysalis, and the last very battered. Caterpillars were however abundant, and included several of the *Sphingidae* and two beautiful Green Caterpillars of *Actias selene*.

On the morning of the 18th I returned to Dhulia, where the nests of a great many common birds were brought to me ; and on the 19th I returned to my station and a vast pile of arrears of work. On the return journey the only thing I noticed was the number of males of *Pericrocotus erythropygus* which were flying about as we passed through the angan jungle near Arvee. This very handsome bird is very common in this narrow belt of jungle, and the hens were evidently sitting. In previous years I have taken many of their nests, the restlessness of the birds, who are constantly flying to and from the nest, at once betraying its position.

J. D.

NOTE ON SOME POST-PLIOCENE MOLLUSCS FROM THE BYCULLA FLATS.

COMMUNICATED BY MRS. W. E. HART.

YOU will doubtless smile if I speak to you of the treasures of the Byculla Flats. But I can assure you the whole of that much-abused region is full of interest, both for the geologist and the zoologist. At no very distant (geological) date the sea must have ebbed and flowed freely eastward, past the site of the Byculla Club, over all that ground now covered with cotton mills and municipal refuse heaps, and intersected by causeway roads and open sewers, which lies between Mahim to the north and Cumballa Hill to the south. At a comparatively recent date its approach from the west was in some degree barred by a sort of breakwater formed by the elevation of the coast-line at Worli. This is clearly shown by the occurrence of fragments of modern sea-shells in the red earth at Worli Point, 16 feet above the present high-water mark. The sandy isthmus just south of Worli village too, in which modern sea-shells are found in good preservation and in considerable quantities 6 feet above the present level of high-water, must once have been the sea-beach at this point. But it was not till the construction of the Vellard Causeway at Mahaluxumi by an English Governor of Bombay in modern times that all access to the Byculla Flats was finally denied to the sea. In the interval it still continued to enter from the south-west at the indentation south of Love Grove, and spread in a broad shallow lagoon over the present level of the Byculla Flats. This was slowly filled as the tide flowed in through the narrow opening between Mahaluxumi Point and the southern

extremity of the Worli Ridge, and again was emptied, or nearly so, as the tide flowed out, much in the same way as we see to-day the low-lying ground about the muddy creeks of Salsette. The entrance being so small and the space beyond so great, it is clear the tide can never have flowed with any great force over the slowly shelving ground inside. Hence it is natural that whatever creatures died in these sheltered shallows, or were drifted into them from the sea outside, would there soon be silted up and preserved in the soft in-washed mud. Hence it is that you will find every spadeful of the soil of the Byculla Flats literally full of the remains of countless sea creatures in a semi-fossilized condition, and for the most part in a wonderfully well-preserved state.

This lump of earth, marked No. 1, is an instance. It was found near the race-course on the top of a bank of earth made of the soil excavated on the spot. Of course the texture of the shells in many instances is greatly altered, or even completely changed, generally owing to the highly aluminous nature of the clay or siliceous condition of the water in which they were deposited. But this only shows how long such specimens must have been lying undisturbed exposed to these influences ; and the fact that they have so well retained their original forms shows how very gradual was the operation of the influences to which they were subjected. The group of fragments of tubular shells, marked No. 2, illustrates this alteration in texture while the original form is preserved. A yet more curious illustration is afforded in every handful of earth about the brick-fields on the west of the Byculla Flats. The soil here is somewhat laminate, very friable, and full of small crystals, apparently of gypsum. And its effect on the shells buried in it seems to have been in some instances to crystallize them, and in others to turn them a dark brown or black colour. In either condition they still retain their original form, but are so brittle, or rather rotten, that the slightest touch reduces them to powder, and I have found it impossible to bring any here in a recognisable shape.

The alteration in texture, considered in connection with the nature of the surrounding soil and general character of the locality, would be of special interest to the geologist. But the shells themselves, whether their texture is altered or not, present several points of interest to the zoologist which I venture to think would amply repay their careful study by a skilled conchologist. I have therefore presumed to invite to them the attention of the members of the Bombay

Natural History Society in the section of "*Other invertebrata*" in the hope that some one may be found more competent than myself to discuss their characteristics.

It seems to me such a discussion might be specially profitable in two ways. First, a careful comparison of these sub-fossil shells of the Byculla Flats with those at present inhabiting the sea outside, with a view to determining such slight differences as may have become permanent during recent geological ages, might throw much light on the theory of evolution and the origin of species ; and secondly, from a study of these marine remains on dry land, we may learn so much of like creatures still inhabiting the sea as to be enabled more easily to find living specimens of species hitherto considered rare from their inaccessibility. It is chiefly in regard to the latter consideration that I propose to offer a few remarks now on these fragments of tubular shells which I have produced for your inspection here to-day.

Among the commonest of the shells scattered over the Byculla Flats are some not unlike pieces of the broken stem of a clay tobacco-pipe. My attention was first directed to them about two years ago by Major R. T. Frere, R.E., who believed them to be the tubes of some boring mollusc. Unfortunately he was compelled by ill-health to go to England before he had prosecuted his researches very far. He took with him however some specimens he had found, and later I sent him some I found after his departure. By comparing these with specimens in the collections of the British Museum and the Royal College of Surgeons, and by the help of information and assistance courteously afforded him by the officials at these two institutions, and particularly by Mr. Etheridge, the head of the Palæontological Department at the British Museum, he collected some interesting information regarding the natural history of tube-forming animals. This he has kindly imparted to me, and I beg to lay before the Society such portions of it as seem to bear upon the specimens which I have collected from the Byculla Flats.

When found in their least altered condition, the tubes are apparently calcareous and nearly white in colour, or faintly tinged with pink. They vary considerably in size. But I have found no fragments larger than those in the group marked No. 3 either in point of length or circumference. I think the reason of this is that the creatures inhabiting these shells used to bore downwards into the soft oozy bottom of the lagoon I have described, big end first. The

excavations hitherto made on the Flats have not yet passed the level at which they attained this circumference, and the length represents the extreme diameter of a clod ordinarily loosened by a stroke of the pick in the work of excavation. When this is lifted, of course so much of the tube as it contains is snapped off and carried away with it. I daresay if we were to dig carefully downwards from the present level of the Flats, we should be able to uncover specimens of greater length gradually increasing in circumference, till at last we reached the lower or big end, as to which I shall have something to say presently, but a specimen of which I have not yet succeeded in finding.

One curious characteristic of these tubes is the way in which they change their direction, as shown in the group of specimens marked No. 4. I would particularly draw your attention to a feature in these to which I shall have occasion to refer again, *viz.*, that wherever one of these changes in direction occurs, it is marked by a little rounded knob or excrescence on the shell. Probably these changes in direction were necessitated, either by the inhabitant of the shell coming on some hard substance through which he could not bore, or by his being obliged to work in a very confined space, by reason of his neighbours crowding on him, or by reason of the limited extent of the soil suitable for his operations at the scene of his labours. The excrescences, I presume, were formed by the animal closing the end of his tube in the old direction when he started in the new to prevent the entry in his rear of water or mud or animals which might cut off his connection with his upper or smaller end.

What then are these tubes? Before attempting a solution of that question, it may be as well to state what they most certainly are *not*. They are not calcareous casts of the stems and roots of aquatic plants, formed by the deposit of lime held in suspension by the water in which they grew on vegetable substances which have since decayed, leaving only their mineral envelopes. You may think that in enunciating such a theory for the mere purpose of demolishing it I am but setting up a man of straw for the pleasure of knocking him down. But I remember Major Frcr once telling me of a passage in some work on the geology of Bombay, in which it was suggested that the shelly tubes found on the Byculia Flats were casts of the roots of the mangrove bushes once growing there when the place was a muddy salt marsh. I have forgotten the name of the book, and I have not been able to find it since; but I believe it came from the library of the

Bombay Branch of the Royal Asiatic Society.* There was much in it that was interesting and valuable. But this theory was certainly wrong. By a curious coincidence, I happened only the other day to pick up near the race-course this specimen, No. 5, which shows, I think, how the theory of the mangrove roots may have originated. You see here is a bit of the root end of some plant firmly embedded in a fragment of tube. It may either have grown up naturally through the tube, which had accidentally fallen and become embedded in the earth in such a position as to allow of this, or it may have been poked in to clear the tube by some inquisitive cooly five minutes before I found it. I incline myself to the former theory, both as the more interesting, and because when I first found the specimen, it was completely filled up to the edge at both ends with earth, some of which has since been shaken out, which would hardly have been the case had the piece of stick been pushed in for the purpose of cleaning out the earth.† But however it got there, there is the piece of the plant in the piece of the tube, and it is not impossible that a hasty observer might jump to the conclusion that the latter was deposited round the former in the manner suggested by the author of the work to which I have referred. The general objection to the theory is that the fragments of calcareous tubes are always single, whereas the roots and stems of mangroves are always branching. In this special instance the space between the shell and the wood, now filled up with earth, shows that the former can never have been deposited on the latter.

But after thus disposing of the theory of another, it is only fair that I should give him a chance by advancing one of my own. My theory is that many (I admit not all) of the shelly tubes found on the Byculla Flats are fragments of the tubes of an interesting and hitherto rare mollusc, belonging to the family of Pholadidæ, and variously known as *Kuphus*, or *Sepetaria*, or *Furcella arenaria*, or *Teredo*

* Since this paper was read, I have found a paper by Dr. Buist on the geology of Bombay at page 167 of the 10th volume of "Transactions of the Bombay Geographical Society." The converse suggestion is here made, viz., that these tubes are the casts of borings made by marine worms through mangrove roots which have been formed by the infiltration of lime held in suspension by rain-water, and deposited in successive layers each monsoon within the outer circumference of the original boring. This theory seems to me as untenable as the other, and formed only for the purpose of accounting for the concentric structure of most at least of the thicker tubes. In the first place, though the fragments of tubes are literally innumerable, I have never yet found one sticking in a piece of wood. In the second place, if the rain-water filtering through the soil of the Byculla Flats were so strongly charged with lime, we should expect to find everything in it thickly coated with lime, not merely the inner surfaces of these tubes. On the other hand, the concentric structure of the tube seems capable of explanation by the act of the animal itself in thickening the tube inwards at intervals, for the purpose of reducing the size of the orifice as it diminished in size itself, in the manner pointed out by Sir Everard Home in his paper mentioned below.

† At the time of reading the stick was pulled out, and found to have been roughly cut to a point, thus establishing the truth of the cooly theory.

gigantea, of the habits and history of which very little seems as yet to be known to conchologists.

I am led to this conclusion by the discovery of such specimens as those in the group marked No. 6, showing a *septum* or division running longitudinally down the tube for some distance from the small or upper end in such a manner as to divide the tube into two. These two divisions are in fact the cases of the two siphonal tubes of the animal—one respiratory and the other excretory—which were closed at will by means of two triangular pallets working loosely within the shell. The union of these two tubes into one through the greater part of their length is the characteristic feature of the Pholadidæ. To the family of Pholadidæ the Teredines are now determined to belong. But it was long before the Kuphus, which I believe these specimens to be, was admitted to a place among the Teredines. M. Rang, who under the name of *Septaria* excluded *Teredo gigantea* (Kuphus) from the genus *Teredo*, while observing that it very closely approximates the Teredines and the Fistulanæ, thus describes it:—“Animal unknown; shell unknown; tube calcareous, thick, solid, in the shape of a very elongated cone, and irregularly flexuous, furnished internally with small incomplete annuliform septa, terminated at one of its extremities by a convexity, and at the other by two slender and separated tubes.”

Rumphius figures, under the name of *Teredo arenaria*, a species of tubular shell found in shallow water, among mangrove trees, apparently identical with that described by M. Rang, and represents the double tube at the smaller end as branching into a distinct bifurcation. This of course is a material difference from the specimens now before you.

Lamarck, still excluding this species of *Septaria*, which he calls *Arenaria*, from the Teredines, recognised only two species of *Teredo*, viz., *Navalis* and *Palmulatus*. The latter he thought differed only in its greater size from the former, which is the species long and unfavourably known to sailors as the borer through the bottoms of wooden ships.

In 1797 Mr. Griffiths discovered at Sumatra a tubular shell apparently of a species nearly identical with these before you. He noticed the difference in the structure of the double tube at the smaller end between his specimens and those figured by Rumphius, but ascribed it to the difference of situation in which they were found. Mr. Griffiths' specimens were procured from a small sheltered bay, with

a muddy bottom, surrounded by coral reefs, on the island of Battoo, near Sumatra, which was exposed by a violent earthquake. The largest was 5 feet 4 inches in length and 9 inches in circumference at the base, tapering upwards to $2\frac{1}{2}$ inches. Most of them were covered with small Oysters and Serpulæ for about a foot from their upper extremity, showing that they must have protruded that distance from the muddy bottom upwards into the water. But owing either to the depth or the muddiness of the water, they had escaped notice till the natural convulsion which laid bare the bottom of the bay. Mr. Griffiths remarked that the large end was completely closed, and had a rounded appearance and was very thin, while the small end was very brittle and divided by a longitudinal septum running down for 8 or 9 inches. Many of the shells he described as nearly straight, while others were crooked and contorted. The substance of the shell he described as having a fibrous and radiated appearance. And herein lies the only essential difference between his specimens and these before you, which for the most part present a concentric, not radiated, appearance.* In all other particulars they approach very nearly to Mr. Griffiths' Battoo Shells, except in their smaller size.

Godfrey Sellius had been the first in 1733 to recognise a true bivalve mollusc in *Teredo*. But it was reserved for Sir Everard Home, R. N., in 1806 to discover a species of *Teredo* in the shells Mr. Griffiths had found at Battoo. He bestowed on it the name of *Teredo gigantea*. He published his discovery in a paper entitled "Observations on the Shell of the Sea-worm found on the Coast of Sumatra, proving it to belong to a species of *Teredo*," and presented the specimens from Battoo, as well as others found in "Another inlet of the sea, sticking out from rather hard mud mixed with sand and small stones from 8 to 10 inches or more and from 1 to 3 fathoms under water," to the Museum of the Royal College of Surgeons. Unfortunately these have now all disappeared, except two marked E348 and E 349c. They are thus described in the Catalogue:—
 "E348.—*Teredo* (*Furcella*) *arenaria*—Rumph. sp. (*Teredo gigantea*, Home). Habitat: Indian Ocean. Presented by Capt. Sir E. Home, R. N. E349.—Specimens marked *a* to *i*. *c*.—The terminal portion of the shell and the double tube."

* In some instances the outer and inner layers are shelly and those in the centre distinctly crystalline. In a few the texture of the shell is crystalline throughout. The animal could not have formed a crystalline shell. But by the action of the mud or water in which it was deposited the shell may have been crystallized, as I have pointed out is common with those found near the brick-fields on the west of the Flats; and the crystals may have been subsequently decomposed by some other influence on the surfaces exposed to it.

Among the lost specimens are some "showing the manner in which the animal closes the tube with transverse septa at certain periods of growth" and "the pallets which are attached to the base of the tube."

Henceforth the right of this mud or sand borer to a place in the genus *Teredo* and family *Pholadidæ* appears to have been always recognised. How or where he got the name of *Kuphus*, or *Cuphus*, or *Cyphus*, for there seems to be some uncertainty in regard to its spelling, by which he is known to Gutteard, I cannot say. But Sowerby in the "*Thesaurus Conchyliorum*" thus describes two species, *giganteus* and *clausus*, of a genus '*Kuphus*,' Gutteard, synonym, '*Furcella*,' Oken:—"The tube of this sand-burrowing mollusc attains the length of some feet, and has been known as the gigantic septaria of Lamarck. The small end which protrudes from the surface of the sand is divided by a central septum, and sometimes forms a double separated tube. The pallets of the larger species only are known; they are spatulate and deltoid. No valves have been found of either species."* The only other known specimens of *Kuphus* in England beside the two I have just mentioned in the College of Surgeons are those in the British Museum. In the family *Pholadidæ*, next to genus *Teredo* is a specimen marked "*Cuphus* (Gutteard)." Under it is written "*Furcella arenaria* (Gutteard sp.)." It is a piece of tube 15 inches long, with a closed and rounded end showing a visible suture. By it are two pallets. There is nothing to show where any of these specimens was found, and no one at the Museum seemed to know. Besides these, in another show-case are two very long and big pieces of tube, wanting the round ends, but showing well the longitudinal division into two at the smaller end. One of them is labelled "Singapore." The other, 3 feet 9 inches long, has no history; but Mr. Smith, the Curator, believed both pieces were obtained from Mr. Charlesworth, a well-known Geologist.

Woodward in 1854, writing of *Teredo*, after describing *T. navalis* and *corniformis*, continues:—"The tube of the Giant *Teredo* (*T. arenaria*, Rumph., *Furcella*, Lamarck) is often a yard long and 2 inches in its greatest diameter. When broken across, it exhibits a radiating prismatic structure. The siphonal end is divided lengthwise, and sometimes prolonged into two diverging tubes." In 1885, Wm. Clark wrote an account of *Teredo*, in which he suggested that certain points

* I have never found any pallets. If they do not exist, it may be because the *Byculla* Flat specimens belong to the smaller species, which to judge from the size of those found would appear to be the case.

of analogy of *Teredo* and *Dentalium* make it appear that the former is the passage between Lamellibranches and Gasteropods; that is to say, putting the proposition in a more popular form, *Kuphus* may be regarded as the connecting link between bivalves and univalves. Lastly, in May 1875 was published an illustrated paper on *Kuphus* in Reeves' "Conchologia Iconica" (probably written by Mr. Sowerby, Mr. Reeves having died in 1865), which thus describes the genus *Kuphus*, Gutteard *Cyphus*:—"Mollusc; sand-burrowing; tube large, white, rough, slightly ringed; posteriorly attenuated; divided interiorly into two tubes; chambered transversely with septiform laminae; valves unknown; compressor palmets shelly deltoid."

The writer goes on to point out that the general appearance of the tube is so like that of the *Teredo* as to leave little doubt of the nature of the animal and its affinity with the genus *Teredo*. At the same time he says it can hardly be included in that genus, the valves having never been seen, and it being certain that the animal does not bore like the *Teredines*.

He figures two species, *gigantea* and *clausa*, the former of which has the lower end broadly open, the latter closed in a rounded oval disc with a visible suture.

It is hard to see how, with a closed and rounded end, *inside* which the valves, if any, must be situated, the animal can have conducted its boring operations through the mud, especially as the shell at this part is described as very thin. I have a theory, of course a mere guess, as I have never seen the anterior extremity of the shell, which you may think it presumptuous in me to advance, but still it does seem to me not impossible that the closed end may be not the characteristic of a species, but due to the act of the individual. We have noticed the rounded projections, the shell of which is very thin, occurring wherever the animal stopped progressing in the old direction and started in a new. Suppose for any reason he did not start again, the tube would end in a rounded projection. Might not this account for the rounded ends of some specimens? Sir Everard Home, in his paper already mentioned, says that both *Teredo gigantea* and *Teredo navalis*, when arrived at their full growth, close up the ends of their shells, and that death is not the consequence of this act. In some of Mr. Griffiths' specimens he says the shell was considerably thickened at the end, and in a few the animal had receded up the tube, forming new inclosures more than once, and at the same time thickening the walls of the tube so as to diminish the canal in

proportion to the diminution of its own size, showing that it must have survived for a considerable time the first closing of its lower end.

You thus see how little is as yet known of this last discovered species of the genus *Teredo*. But this scantiness of information and paucity of specimens may be attributed rather to the inaccessibility than to the numerical scarcity of the creature. For an animal that bores several feet deep into a muddy bottom several feet below water cannot be said to offer much encouragement, at least to human beings, to make his acquaintance. But the introduction may in a measure be facilitated if the tubes to be found in such numbers about the Byculla Flats are in fact the remains of this creature. That they are, I think, may be inferred. First, from the similarity of the place in which they are found to that described as the home of Mr. Griffiths' "Sea-worm." At the time when the Indian Ocean ebbed and flowed across the Byculla Flats, their condition must have nearly resembled that of the shallow sheltered bay, with a muddy bottom, in the neighbourhood of Sumatra. Secondly, the general appearance of the shelly tubes here agrees with the descriptions I have quoted to you in every point, except that the structure is concentric instead of radiating, which may be due either to a difference of species or to the alteration the shells have undergone in the process of fossilization.* Thirdly, and most important, we recognise here the longitudinal septum, dividing the tube into two for some inches of its length, which characterized the shells discovered by Mr. Griffiths.

It is true that in the descriptions and specimens I have mentioned of *Kuphus*, there are the closed and rounded lower ends which I have not yet succeeded in finding. But these are probably still awaiting discovery some few feet lower down. Major Frere tells me he found one, but I am sorry I never saw it. I have found these two specimens, marked No. 7, which at first I was inclined to hope might be the extreme tips of the rounded ends, the shell of which you will remember is described as being very thin. I am however now inclined to think that they are nothing more than the excrescences, which we saw the animal threw out in his shell whenever he changed his direction, and which have been knocked off the tube. The group of

* If the process of crystallization were gradual, and the crystal were substituted for the shell in successive layers, but were afterwards decomposed, say by heat, the structure of the tube would be concentric and the texture non-crystalline. If the heat were not sufficient to penetrate the whole thickness of tube, the centre layers would still be crystalline, as first altered from the shell, and the outer and inner non-crystalline, not according to the original structure of the shell, but owing to the second alteration it had undergone from its crystalline shape.

specimens, marked No. 8, shows how prominent some of these excrescences are, and how easily in consequence they might be knocked off.

I think, from the very large number of the tubes now to be found loose on the Byculla Flats, that the animals inhabiting those tubes actually lived in the soil of which the Flats are composed, and that if we dug further down we should come upon their lower ends. But of course it is possible that the fragments of tube now found on the Flats were only washed in from outside, and that the lower ends are still sticking, head downwards, in some other soil. The fact that we have only found upper ends as yet on the Flats lends colour to this theory. The two specimens, marked No. 9, however still show the sort of soil in which to look for the animal. These are evidently lumps of clay, though now considerably indurated, through which, while soft, the creatures which inhabited these tubes were working their way.

Bearing this in mind, and remembering the description of their habitat as given by Mr. Griffiths, I would recommend careful search to be made in those sheltered bays and creeks, which so abound in the neighbourhood of Bombay, with muddy bottoms over which the tide flows with no great violence to a height of from 6 to 15 feet. If once we can find their home, there will be no lack of specimens, for the abundance of remains on the Byculla Flats shows that, in numbers at least, they are not deficient. A large capture of living specimens would probably be attended with important results to science generally. It would certainly be a valuable addition to the best collections in England, and would reflect great credit on this Society. It will however be necessary to remember that as all that glitters is not gold, so every tube is not a *Kuphus*. Here is a small group of specimens, marked No. 10, which are the tubes of *Dentalia*, also very common on the Byculla Flats. One you see, comparatively modern, is hardly altered at all; but the others from their appearance might be coeval with the oldest and most altered of the specimens of *Kuphus* to which I have introduced you. The *Dentalia*, you will remember, are the creatures referred to by Clark in propounding his theory that "*Teredo* is the passage between *Lamellibranchs* and *Gasteropods*." They also are very interesting creatures, because, if *Gasteropod* at all, they are very exceptional members of that order. Huxley regards them as *Pteropods*. They constitute a very lowly-organised group without distinct gills or heart and with a but imperfectly developed head. The slender tubular shell, as you see from these specimens, is curved,

tapers suddenly, has no division, and has an aperture at each end, that at the smaller being quadrangular, features which readily distinguish it from *Kuphus*.

But I must not allow myself to be betrayed into trespassing further on your patience. If I were to attempt to describe all the shells to be found on the Byculla Flats I should never have done. Among them I have no doubt are many besides *Kuphus* that have hitherto enjoyed a reputation for scarcity, simply because by their inaccessibility they have been seldom seen and little studied. By conveniently investigating these remains at our leisure on dry land, we may learn so much of the history and habits of the animal as to be able more readily to secure living specimens in the neighbourhood.

J. B. H.

24th July.

THE BIRDS OF SOUTH GUJERAT.

BY H. LITLEDALE, BARODA.

IN Major E. A. Butler's excellent list of the "Birds of Sind, Cutch, Kathiawar, North Gujerat, and Mount Abu" (in the *Bombay Gazetteer*) several birds are omitted which have been found in South Gujerat and the Panch Mahals, and which I think must certainly extend to North Gujerat and the Rajputana Forests at least, if not to Eastern Kathiawar also. The fauna of any district will obviously be intermediate between the faunas surrounding it, and one cannot draw a hard-and-fast line beyond which birds are *never* found to travel. In fact "never" is a word that the Ornithologist should specially beware of; with birds "the world is all before them where to choose," and they exert their privilege of choice to an extent that often upsets the dogmatic Naturalist, whose "never" has to be modified into "hardly ever" to suit the facts of the case.

12. *Falco babylonicus* (Gurney).—The Red-cap Falcon is only recorded by Major Butler from Sind; but Mr. Doig shot one at Sanand, near Ahmedabad.

27. *Aquila mogilnik* (S. S. Gm.).—Mr. Doig has shot at the same place; Butler only records it from Sind.

35. *Limnoctus cirrhatus* (Gm.).—The Crested Hawk-eagle Major Butler records from "Mount Abu, rare." Mr. Davidson writes to me that "it must breed with you; it is the common Eagle in West

Khandesh, and from our hills, Pavagarh (a mountain 28 miles north-east of Baroda), is seen;" but I have not yet found it. It probably will turn up in the hilly forests of Chota Udepur and the Panch Mahals.

39. *Spilornis cheela* (Lath.).—The Crested Serpent-eagle Butler records only from "Sind, rare." Mr. Barnes (*Birds of Bombay*) says it "is very rare; one was obtained at Savantvadi by Mr. Crawford; and another in Sind by Mr. Blandford: these are, I believe, the only recorded instances of its occurrence within our limits." I shot a female and got an egg in a nest at Pattra, 15 miles from Dohad, Panch Mahals, 12th April 1886. Mr. Doig and I were both of opinion when examining it in the flesh that this bird was true *cheela* and not *minor*, and so I think its right place is in the museum of our Society, where it will be found by any one wishing to verify the record, which, as we had only measurements to go by (Hume, *Rough Notes*, Jerdon and Barnes being consulted), and no skins to compare, would be desirable. The nest was in a fork of a *Kodai* tree, in thin jungle, 20 yards in from the flank of the bed of the Anas River. It was a poor straggly affair, not bigger than a Kite's, and hardly so compact. The egg, handsomely blotched and streaked with dark red at the larger end, measures 2.6×2.2 . On the 25th of May I saw a pair of either this species or *S. minor* feeding a young bird near Beecheewara (Dungarpur, Meywar).

57. *Pernis ptilorhynchus* (Tem.).—Major Butler records the Crested Honey-buzzard from "Mount Abu, rare." Mr. Doig tells me that he has shot it in the Ahmedabad District; he and I found a nest, one egg, in a high *Kadai* tree in thickish jungle at Singargarh, near Saonth, Panch Mahals, and shot the female on the 25th April 1886; and we saw another at Saran, near Dungarpur, Meywar, 5th May 1886. The egg was white, faintly marked with cold brown at the larger end.

65. *Syrnium ocellatum* (Less.) is said by Butler to be a "permanent resident (I believe)." I found its nest, two eggs, 4th March 1886, near the Race-course, Baroda. One egg was much harder set than the other, and had a bloodstain on it from the remains of a half-eaten squirrel that lay beside it. In 1885 I was too late for this nest, finding one fluffy little fellow snapping his bill at me when I called on the family on the 31st March.

72. *Ketupa ceylonensis* (Gmel.).—"Sind, rare," says Major Butler; "has not yet been recorded from Gujerat, neither did I meet with it in Rajputana or Central India" says Mr. Baraes. Mr. Doig and I saw three, and shot one adult and one young bird at Saran, near

Dungarpur, Meywar, 7th May 1886 ; and Mr. Doig shot a specimen at Harsole, near Ahmedabad, in 1884. The young one at Saran seemed about four months' old.

74. *Scops permatus* (Hodgs.)—"Sind, cold-weather visitant, rare," is all Major Butler records ; and Mr. Barnes says it "occurs sparingly throughout the district, except perhaps Gujerat." I therefore record that on the 8th February 1886 I shot one, in the rufous phase of plumage, at Pavagarh, on the hill-side above Champanir, and my shikarry said he saw another which was *white* (*i.e.*, the adult phase).

75ter. *Scops bakkamuna* (Forst.)—Mr. Doig got a family of six of these at Saran, and I kept one of the young ones alive for several days ; they are only recorded from Sind and Abu, and with nocturnal species every occurrence is worth record. The nest-hole was in a high *Mowra* tree, and was inhabited also by a colony of tree-ants, who made it uncommonly hot for the man who got down the Owlets for us ; in fact he twice "resigned," but the sight of a depreciated "dib" encouraged him to persevere and succeed at last.

77. *Glaucidium radiatum* (Tickell).—Butler only records this from the jungles at the foot of Mount Abu ; but we found it common in the mahals from Dohad northward to Saran (Meywar) ; and *A. brama* correspondingly scarce, and only near the villages.

98. *Cypselus melba* (Lin.).—I only mention to protest against Major Butler's remark "only occurs, as a rule, in Gujerat, *within reach of the hills*." As the Gujerat Alpine Swifts are within reach of the Himalayas if they choose to go there to roost and return in the morning, this seems an unnecessary limit to place on the range of birds with such wonderful powers of flight ! I have frequently seen them overhead near Baroda, and have shot them on the 21st September.

104. *Dendrochelidon coronata* (Tick.).—This lovely bird is not in Butler's list ; but it is quite common in the hill jungles of the Panch Mahals, especially near the tanks in those jungles. I found a nest with egg on a thin bough of a leaf less tree, 20 feet above the path in the midst of jungle, near Saran. The nest was hardly $1\frac{1}{2}$ inch in diameter, including the bough to which it was glued ; and both nest and egg are safe and sound in my collection—a feat which Mr. Hume (*Nests and Eggs*) never managed to accomplish, and he says "it is almost impossible to get the egg (for they lay only one) down unbroken.

118. *Merops philippinus* (Lin.).—Major Butler only records from

“Mount Abu, rare, occurring only as a straggler.” This leads me to remark that Major Butler does not appear to have fully worked out these species, that keep along rivers such as are more common in South than in North Gujerat. This species is common enough, and breeds along the Mahi from the mouth nearly to the source ; it has to keep to the larger rivers during the breeding season (May), leaving them for the meadows during the rains.

124. *Coracias garrula* (Lin.).—Butler says “Sind ; seasonal visitant ; not common.” Mr. Doig notes in my copy of Barnes : “very common in Gujerat, the Ahmedabad districts, in August and September, and again in February ;” and I saw two at Goblej, near Khaira, September 27th, 1886.

127. *Pelargopsis gural* (Pears.).—The Stork-billed Kingfisher is not recorded by Butler ; but we found it along the Mahi in the Panch Mahals (and see my paper in No. II. of this Journal).

147. *Palaeornis eupatria* (Lin.).—Butler refers to one Sind specimen of doubtful authority. Mr. Murray (*in Epist.*) says “this was undoubtedly a cage-bird escaped ; tail feathers much abraded.”

164. *Yungipicus nanus* (Vig.).—“Mount Abu, rare,” says Major Butler. Mr. Doig saw a pair, and shot a male near Ganji, Dungarpur, Meywar, 4th May 1886. It measured only $4\frac{3}{4}$ inches in length.

193bis. *Megalaema inornata* (Wald.).—Common in the jungles of the Panch Mahals and at Pavagarh.

238. *Dicaeum minimum* (Tick.).

240. *Piprisoma agile* (Tick.).—Neither of these little flower-peckers is in Major Butler’s list ; they are both permanent residents about Baroda.

250. *Sitta castaneiventris* (Frankl.).—Not in Major Butler’s list. I shot a pair at Saran, Dungarpur, Meywar, and saw two others there 5th May 1886. They did not appear to be breeding then.

268. *Volvocivora sykesii* (Strickl.).—Major Butler records from “Abu and the low hills east of Deesa ; rare.” It goes east after the rains, and I saw it not unfrequently in the Panch Mahals in May, doubtless on its way west to breed, which it does about Baroda.

285. *Dissemurus paradiseus* (Lin.).—Not in Major Butler’s list, but “breeds in the east of Godhra, and therefore probably throughout the Panch Mahals” (J. Davidson, Esq., c.s., *in Epist.*)

293. *Leucocerca leucogaster* (Cuv.), which Major Butler only records from Abu, breeds at Baroda also, though rarely, *L. aureola* being by far the commoner species.

297. *Alseonax latirostris* (Raffles).—Is not in Major Butler's list; and Mr. Barnes says "it has not been recorded from either Sind or Gujerat." I found it common at Saran in Meywar; shot a female, May 9th, 1886. It is so like a Sparrow that doubtless it has been often overlooked, and will probably be found in quiet shady places, over water, throughout the jungles of the Presidency, except Sind. Although in appearance like a Sparrow, its manners resemble those of 305, *Cyornis tickelli*, especially in its robin-like flutter of the wings when standing. I saw it *whacking* some insect several times on a bough, just as a Wood-shrike does, and then swallowing the big morsel whole.

452. *Ixos luteolus* (Less.).—Not in Major Butler's list, but common about Baroda and in wooded ravines throughout the district.

459. *Otocompsa leucotis* (Gould).—Though common in the more desert tracts to the north, I have never seen this bird in the park-like country south of Ahmedabad to the Nerbudda. Mr. Barnes however says it "is far from being uncommon in Gujerat."

463. *Phyllornis jerdoni* (Blyth).—Not in Major Butler's list, but nevertheless occurring sparingly about Baroda, and more commonly in the forests of the Panch Mahals.

467 & 468. *Iora zeylanica* (Gmel.), which Major Butler records only from Abu, and "not very common" there, is very plentiful about Baroda, where I have found many of its nests.

475. *Cospychus saularis* (Lin.).—Major Butler calls this a "cold-weather visitant." A pair have just left my porch with their young family which they reared there this June! I saw seven adult birds together in a mango grove at Jhalod, Panch Mahals, 20th May 1886.

481. *Pratincola caprata* (Lin.).—Major Butler calls this a permanent resident in Gujerat; but it certainly is not found in the Baroda District from April to September, and though we specially watched for it, neither Mr. Doig nor I saw *one* in the Panch Mahals last April and May.

490ter. *Saxicola capistrata*. } Not in Butler's list, but recorded from
517. *Luscinola neglectus*. } Sind in Murray's *Verteb. Zool. of Sind*.

553. *Hypolais rama* (Sykes).—Although the *Phylloscopinae* are all cold-weather visitants, it is very probable that others breed in Sind besides this species, which Mr. Doig found breeding plentifully there.

558. *Phylloscopus lugubris* (Blyth).—Not in Butler's list, but I shot one out of a flock of five near Baroda Race-course, 17th September 1885; and Mr. Barnes says "very rare winter visitant to the Deccan," which give us two landmarks on its line of migration.

582^{bis}. *Sylvia minuscule* } Neither in Butler's list; both in
582. *S. althea* } Murray's *Verteb. Zool. of Sind*.

560. *Phylloscopus viridanus* (Blyth).—Not in Butler's list. Shot one at Pattra, near Dohad, Panch Mahals, 14th April 1886. Merely a cold-weather visitant to the Deccan" (Barnes).

631. See previous paper, Journal No. II.

647. *Machlolophus xanthogenys* (Vigors).—Not in Butler's list. Mr. Doig shot a male in a mango grove at Jhalod, Panch Mahals, 21st April 1886, evidently breeding or about to breed; and we saw a pair at that "bird paradise" Saran,* near Dungarpur, about ten days later.

674. *Dendrocitta rufa* (Lath.).—To my previous paper (Journal No. II.) let me add regarding this bird that I counted twenty-three (23) of them fly out of one tree at Kadana on the banks of the River Mahi, Panch Mahals, 28th April 1886, and found them very common in the jungles between Dohad and Khairwarra at that time.

Serinus pectoralis (Murray), *sp. nov.*—Not in Butler's list. (See *Verteb. Zool. of Sind*, 193, as also p. 201 for 784, *Pakumbus casiotis*.)

765. *Spizalauda deva* (Sykes).—Not in Butler's list; but this is the commoner sort about Baroda, and *S. malabarica* the rarer.

805 & 306. *Cyornis tickelli* (Blyth).—Common in secluded spots, near water, throughout Gujerat, though not recorded from that district by Major Butler.

839. *Sypheotides aurita* (Lath.).—Have found it breeding about Baroda at the following dates:—19th August 1885.—Two eggs, and a third, a bright green colour, extracted 21st September 1885.—

* There is a stream from a spring here, with overhanging trees, and not another drop of water for miles around. The little stream is only about 5 yards broad, and after a course of 300 yards or so disappears in the sand; but I noted in my diary at the time the following birds in that one little oasis:—Green Barbets (*inornata*), Copper-smiths, Common and White-bellied Drongos, Doves, Green Pigeons, Nuthatches (250), Tickell's Blue Redbreast, Titmice (Grey and Yellow-cheeked), Orioles, Koels, Crows, Sparrow-hawk (on nest, three eggs), Owlets (*A. radiata*, *Scops bakhamuna*), Paradise and Fantail Flycatchers, Kingfishers (*P. gural*, *C. rudis*, *H. smyrnensis*, and *A. bengalensis*), Woodpeckers (*Aurantius* and *Mahrattensis*), Common Sand-pipers, Lapwings, Painted Sand-grouse, common Mynahs, White-throated, Hodgson's and Stewart's Wren-warblers, Tree-pies, Common and Yellow-throated Sparrows, Bulbuls (462), Brahminy Mynahs, Fish-owls (*K. ceylonensis*), Crested Tree-swifts, Crested Honey-buzzards, Babbler, seven large Grey Cuckoo-shrikes, Magpie Robins, Green Bittern, Rose-ringed and Rose-headed Parrakeets, Mottled Wood-owl, Indian Nightjar—what a choir!

Caught three chicks just out of shell; no nest; fragments of shell on a flat bit of ground amid thin grass. 9th August 1886.—Four fresh eggs. 13th September 1886.—Three fresh eggs. All the foregoing from near Bakrol, six miles from Baroda.

842. *Glareola orientalis*.

845bis. *Ch. pluviatis*.

847. *H. ventralis*.

} Not in Butler, *vide* Murray, *op. cit.*

843. *Glareola lactea* (Tem.).—The Lesser Swallow Plover not in Butler's list, though common in the sandy, rocky bed of the Mahi above Wasad. I got 18 eggs in the bed of the Mahi above Sihora, 6th April 1886. There were no nests, and the eggs were either single or in pairs on islands. Some were far in under the ledges of rock; others right out on the gravel; and the sheltered eggs were far finer coloured than the exposed ones.

900 *Parra indica* (Lath.).—Butler says "permanent resident, *I believe*." It breeds commonly about Baroda, laying its eggs on the floating lotus leaves. People in India generally call this bird a Jacana, pronounced Jakana; but the name is spelt Jaçana in Coues's *Birds of North America*, and that indicates the correct pronunciation I believe, though Ogilvy's dictionary pronounces it as *Jakana*.

924bis. Not in Butler, *vide* Murray, p. 270.

932. *Ardetta flavicollis* (Lath.).—Only recorded from Sind by Major Butler; but Mr. Doig got it near Ahmedabad; and I saw a pair near Baroda, May 1884, but as I was waiting for a Panther (that never came), I did not secure a specimen.

850. *Ægialitis minuta* (Palls.).—To the instances recorded by Major Butler I may add that I have frequently shot it along the Mahi, and found two nests, three eggs each, last April 6th, at Sihora. On the Mahi south of Dakore on the same day I found three nests, two eggs each, of *Æsacus recurvirostris* along the river-bed, thus justifying Butler's remark of this species, (858) "permanent resident, *I believe*."

NOTE ON A RECENT PAPER BY DR. BONAVIA ON THE MANGO.

BY SURGEON K. R. KIRTIKAR, I. M. D.,

Acting Professor of Anatomy, Grant Medical College, Bombay.

UNDER the presumption that he was presented with real Bombay mangoes. Dr. Bonavia without reserve declares that they were

disappointing. He describes them as having a red cheek and yellow colour ; they were stringy. The very fact of their being stringy precludes them from being considered the real Alphonso mangoes, much less could they be considered the best. Any mango grown in Bombay, or around Bombay, may have a red cheek and yellow colour ; but that does not make it a good mango. The entire absence of strings is *the* characteristic of the real Bombay *Alphonso*, or *Afoos* as it is popularly called. The mesocarp, or rather the sarcocarp, consisting of the pulp of the fruit, can be cut through like fresh cheese that is not very hard, or can be easily scooped out by means of an ordinary dessert spoon with a clean cut. As regards the real mango being inferior in flavour to the scores of varieties Dr. Bonavia has seen in Upper India, even supposing he has tasted the best Bombay mango, it is a mere matter of taste. There is no accounting for tastes. There is room for wide varieties. The common Konkani kunbi will never care to eat the finest table-rice that a high class Hindu would prefer. The kunbi would prefer his coarse rice, which he declares is sweeter and more substantial. Children will never eat, at any rate fully appreciate, the real *Afoos*, but will be content to suck the juice of the *Raiwal* or smaller varieties of mangoes. The real Bombay mango is luscious, sweet as honey, and its epicarp or rind very thin, almost transparent. The thinner it is the better, and such as can be easily peeled off without tearing through the rich and succulent pulp. It does not matter then whether it has a red cheek or not, or whether it is yellow, or rich orange, or saffron coloured. To turn out a good mango, free from acidity, the mango must be plucked at the proper time. The nearer it is to the ripe condition while yet on the tree the better will it turn out. If the mango is plucked immature, even if it be of the best kind, it will fail to give satisfaction. It will often, near the stone and a portion of its pulp, remain pale in appearance, and often form fibrous cavities, and will be acid to taste, showing that there has been a localized gangrene of the parts concerned. A good mango on the other hand, plucked perfectly mature and about to ripen, will require certainly not more than five, six, or seven days at the outside to be fit for the table. "The mango may bear," I agree with Dr. Bonavia, "being plucked under-ripe, and can *easily*"—so far as transit is concerned I think—"be sent to England and there ripened," but I question if it would ever ripen under such circumstances to perfection. A good mango can never ripen well, much less to perfection, under the chilling influence of the cold used to preserve it. Cold may prevent

decay and decomposition, but I doubt whether will ever hasten ripening or help it. I think it deteriorates the fruit. Cape pears may find a market in Covent Garden, and so would Bombay mangoes with a brisk journey of nineteen days across the continent if carefully packed and looked after constantly during the Red Sea voyage and continental journey. But in my opinion there would always be a difference between a fresh mature mango ripening under natural processes in five days and an under-ripe mango ripening in twenty days under forced conditions and chilling preservative influences.

There is often so much deceit practised by the mango-sellers in the bazaar that an unwary and uninitiated foreigner is likely to be taken-in and presented with any wretched mangoes—perhaps some thick skinned Goa mangoes—under the name of Alphonso mangoes. But anybody that knows what a real mango is, from its taste, appearance, flavour or aroma and texture, will always recognize it. Even the feel is characteristic; and the smell, without cutting, is diagnostic. The first gatherings of these mangoes are always defective and sold at enormous prices, and Dr. Bonavia has a just reason to complain when he finds that Rs. 6 have to be paid for a dozen mangoes. People are so impatient to eat the first fruit of the season that they pay down any price. The agents of the up-country Rajahs buy them up at fabulous rates, as the Rajah's money is almost without a guardian in such cases. Induced by the hope of making an easy fortune, the mango contractor takes the earliest opportunity to have his pick of the fruit, and in doing so often plucks under-ripe mangoes, which sometimes never ripen at all or, if they do, do not develope into the perfect fruit and are insipid. Sometimes they rot during the ripening process. I have had an opportunity of tasting some Upper India and Sind mangoes, and the Deccan, Goa, and Bangalore ones are common enough, but they do not come up to the Bombay fruit. It is not my intention at present to write anything on the different varieties of the mangoes found in Bombay. During the next mango season the Bombay Natural History will hold an exhibition of the different varieties of the mango, when it is hoped a careful list of the various kinds will be made out.

I come now to another part of Dr. Bonavia's remarks. When he says that he has preached for many years that "it is a grave mistake to throw away the thousands of stones of superb mangoes that are consumed every year," one would think that Dr. Bonavia has practical experience in the matter sufficiently strong to substantiate his remarks. He is clearly mentioning what is contrary to the actual

experience of mango-culturists on this side of India when he says that "it does not at all follow that a stone of a good mango will not give a *better* fruit than that of its parent." The common experience here is that a seedling is not only not better than its parent in the production of the proper fruit, but as a general rule is not even as good as its parent. For instance, a good Alphonso or Pâyari (spiked or sharply curved at the apex) can never be cultivated out of its respective seedlings. They always degenerate, no matter what the parent is. A special mango has always to be obtained from grafts. Grafting mangoes is an industry which is very paying, and now that the whole island of Salsette is under extensive cultivation at the hands of intelligent and painstaking landowners, it is certain that at no distant day Bombay will be abundantly supplied with excellent graft Alphonso and Pâyari mangoes. Notwithstanding the high authority of DeCandolle, quoted by Dr. Bonavia, with regard to the mango cultivated in the colony of Cayenne bearing stones *which produce better fruit* than that of the original stock, the common experience in India with regard to the Alphonso or Bombay mango is different. The seed as it develops into a plant takes a long time to bear fruit, the fruit itself losing the characters of its parent. The seed of an Alphonso mango will not produce an Alphonso fruit, but degenerate into a common Raiwal.

K. R. K.

A CATALOGUE OF THE FLORA OF MATHERAN.

BY THE HON. H. M. BIRDWOOD, VICE-PRESIDENT.

A RECENT visitor to Matheran is said to have complained sadly of the monotony of its vegetation. That too familiar "Matheran tree" was everywhere, and everywhere the same; and though it was very beautiful, with its glossy leaves and purple plums, it so impressed its sameness on the landscape as to induce a sense of depression, from which the visitor was glad to escape. It is just possible that his experience was not altogether singular; for we do not all cultivate alike the faculty of observation. Two men, with the same love for the beauties of Nature, and with equally good eyesight, may look on the same fair scene of hill and forest, sea and sky, with very different apprehension of its infinite variety, and with very different degrees, therefore, of satisfaction. The one may take in, with the trained eye of the artist, notable details which the other misses. He will see

wondrous shapes and colours, and gradations of colour, in every wave and cloud, and leaf and boulder, where the other sees only trees on the steep hill-side and a waste of water dappled with shadows. It is one of the main advantages of our Society that it teaches its members to make a right use of their eyes; and in some of us, the discovery that even blades of grass are not all alike may perhaps have awakened into activity a faculty hitherto dormant. So that now, in our continued researches in the vegetable world, we become aware of a multitude of beautiful forms, hitherto unnoticed, which daily reveal themselves to us; and it is no more possible for us now to be oppressed by the sameness of our surroundings, whether at Matheran or elsewhere. But though a thirst for knowledge has been thus created, we cannot so easily quench it. We have no leisure for systematic study; and when we consult our standard authors for information about plants, we are repelled by a difficulty which meets us at the outset. We cannot refer to the works of Hooker or Roxburgh, Brandis, Graham or Dalzell, with any readiness or comfort, if we have first to find out laboriously for ourselves the scientific names of plants by which alone they are generally known to these writers. Though this difficulty may be reduced, it is not quite removed by the use of such a synopsis of Orders as that contained in the "Artificial Key" to Orders I. to LXXI. of Dalzell and Gibson, published in 1875 by Captain H. H. Lee, R. E., or in the Revd. Dr. Fairbank's "Key to the Natural Orders of the Plants of the Bombay Presidency," published in 1876; and members of our botanical section are still unprovided with correct lists of the local names of plants, with the aid of which they would find it a comparatively simple matter to acquire the information they are in search of. No doubt, we find valuable glossaries of vernacular names in Roxburgh and Brandis; but the names are not always those in use in this Presidency, and the glossaries do not, therefore, sufficiently meet the requirements of students of the rich flora of Bombay and its neighbourhood. And this remark applies also to the very full list of Bombay names in the index to Sir George Birdwood's "Vegetable Products," which is meant for the use rather of the physician, the merchant, and the agriculturist than of the mere botanist. It is in the hope, then, of removing this initial difficulty, to some extent, as regards the vegetation of a certain limited area, which is much visited by members of our Society, that I have compiled this catalogue, which furnishes a ready method of learning the scientific name

of a plant of which the vernacular name is known. Almost every coolie at Matheran knows the names of most of the Matheran trees. Indeed for some plants you may get a brace of names or more, if you will only question your informant long enough. My own particular coolie, Krishna, in the course of two hours spent in the Primeval Forest and below Chowk Point, gave me no less than 75 names, which he told me he had learnt in the forest, with an air as if the trees themselves had told them to him. With full confidence in the sources of his information, I have included these names in the third column of the catalogue and in the index appended to it, with many others furnished by Mr. Jaykrishna Indrajī, Curator of Forests in the Porbandar State, a keen botanist, who lent much efficient aid to the late Dr. Sakharam Arjun in the collection of his Bombay herbarium. I am much indebted indeed to him, and also to Dr. Kirtikar, for carefully revising the whole of the catalogue, which can now, with the aid of Krishna or any other hill florist, be used for the purpose for which it is intended. I would only add that those who so use it must not expect to find it by any means a complete list of the flora of Matheran. It is a fair-weather catalogue, written in the month of May and the early days of June, when many plants which blossom in the rains or the cold-weather are dried up, past all recognition. It is a completer list, therefore, of trees and perennial shrubs and climbers than of herbaceous plants; though it contains also the names of a few such plants, inserted either from memory of past cold-weather visits to the Hill, or obtained from friends or from Mr. Campbell's Gazeteer, or the Revd. Mr. Gell's Catalogue, published now many years ago, and afterwards republished by Dr. Theodore Cooke. Such as it is, it is as complete as it could be made in the course of several very pleasant rambles in the company of our Vice-President, Dr. D. MacDonald, Mr. Chester MacNaghten, and Mr. Jaykrishna. Such as it is, I offer it to the Society as an instalment only of a work which I hope will be taken up, continued, and enlarged by others, if not by myself, till we are in possession of tolerably complete catalogues of the flora of all parts of the Presidency. I can only hope that members of the Society who have the good fortune to visit Matheran during the next six months will remorselessly criticize and amplify my work and favour our editor in due course with the result of their labours. To this end, I have asked Mr. Sterndale to issue a few interleaved copies of the catalogue in pamphlet form, and these can be procured from the Secretary.

CATALOGUE.

NOTE.—In the first two columns, the nomenclature adopted for the first 51 orders, exclusive of Order 33, "*Loranthaceæ*," is that of Hooker's "*Flora of British India*," Vols. I—IV, which do not include "*Loranthaceæ*," or the Orders 52—78 represented in this catalogue. The synonyms given in the second column are the names under which the plants are described in Dalzell and Gibson's "*Bombay, Flora*." Where no synonyms are given, the plants are described under the same names in both Hooker and Dalzell. In the third column, the names are spelt, for the most part, according to the Hunterian system. The word "vel" or "yel," which recur frequently as a component part of a name, means a "creeper" or 'climber.' The words "lahan" and "dhakta" (fem. "dhakti") mean 'small,' "mota" (fem. "moti") means 'big,' "pandhra" means 'white,' "kala," 'black' "tamra," 'red,' and "karu," 'bitter.' The prefix "ran" indicates a "jungle plant," or as we should say "a wild plant," though all the plants in the list are of course wild or indigenous plants on the hill, with the exception perhaps of the Jack-tree (*Artocarpus integrifolia*).

Natural Order.	Genus and Species.	Vernacular Name.
1 Ranunculaceæ.....	<i>Clematis triloba</i>	Mor-vel, Ránjái.
2 Dilleniaceæ.....	<i>Dillenia pentagyna</i>	Karambel, Dákhta Karmal.
3 Anonaceæ	<i>Uvaria Naram</i>	Naram-panal.
"	" <i>lurida</i>	
"	<i>Bocagea Dalzellii</i>	Sajeri, Hár-kinjal.
	<i>Syn. Sageocea laurina</i>	
4 Menispermaceæ ...	<i>Cocculus macrocarpus</i>	Vátoli, Vát-yel.
"	" <i>villosus</i>	Tán, Vásanvel (Sanskrit Vásadani).
"	<i>Cyclea peltata</i>	Pár-yel.
5 Capparideæ	<i>Capparis pedunculosa</i>	Kolisna.
"	" <i>horrida</i>	(Near Alexander Point.)
6 Tamaricaceæ	<i>Tamarix ericoides</i>	Jao, Sarub, Saráta.
7 Guttifereæ	<i>Garcinia indica</i> .. .	Kokam, Rátamba (Wild Mangosteen).
"	" <i>ovalifolia</i>	Haldi.
	<i>Syn. Xanthochymus ovalifolius</i>	
"	<i>Ochrocarpus longifolius</i> ...	Harkia, Surangi.
	<i>Syn. Calysaccion longifolium</i>	
8 Dipterocarpeæ.....	<i>Ancistrocladus Heyneanus</i> ...	Kardor, Kardori.
9 Malvaceæ	<i>Hibiscus birtus</i>	
"	<i>Thespesia Lamias</i>	Rán-bhendi, Láhán-bhendi
"	<i>Bombax malabaricum</i>	Sáwar, Támri sáwar
	<i>Syn. Salmalia malabarica.</i> }	(Silk-cotton tree).
10 Sterculiaceæ	<i>Sterculia guttata</i>	(Sanskrit Rakht-shálmali).
"	" <i>colorata</i>	Goldor, Gordar, Kukar.
"	" <i>urens</i>	Bhaikui, Khavas, Khaushi.
11 Tiliaceæ	<i>Grewia tiliaefolia</i>	Sáldhawal, Karai, Kuari.
"	<i>Erinocarpus Nimmoanus</i>	Dhámán.
"	<i>Triumfetta pilosa</i>	Chaurá, Chor, Cher.
"	" <i>rhomboidea</i>	Kutre vandre ("Doga and Monkeys").
"	"	Necharda.

Natural Order.	Genus and Species.	Vernacular Name.
12 Geraniaceæ	<i>Impatiens acaulis</i>	Lábán Tirda, Berki.
"	" <i>oppositifolia</i>	Saumukh patri, Tirda (Wild Balsam).
13 Rutaceæ	<i>Atalantia monophylla</i>	Mákar-limbu ("Monkey Lime").
	<i>Murraya Koenigii</i>	Karepát, Karu-nimb.
	<i>Syn. Bergera Koenigii</i> ... }	
	" <i>exotica</i> (var. <i>paniculata</i>)	Pándri, Kunti.
14 Meliaceæ	<i>Soymita febrifuga</i>	Polá-á.
	<i>Chloroxylon Swietenia</i>	B.ku, Haldá.
15 Celastrineæ	<i>Gymnosporia montana</i>	Yekdi.
	<i>Syn. Celastrus montana</i> ... }	
"	<i>Gymnosporia Rothiana</i>	Moti Yekdi.
	<i>Syn. Celastrus Rothiana</i> ... }	
"	<i>Hippocratea Grabami</i>	Yevti.
16 Rhamneæ	<i>Ventilago madraspatana</i>	Káuvél, Lokhandi.
"	<i>Zizyphus xylopyra</i>	Guti, Ghuti (Hart Point and elsewhere).
"	" <i>rugosa</i>	Toran.
17 Ampelideæ	<i>Vitis discolor</i>	Telitsa yel.
	<i>Syn. Cissus discolor</i>	
"	" <i>latifolia</i>	Nadena.
	<i>Syn. Cissus latifolia</i> ... }	
"	" <i>lanceolaria</i>	Kajgolitaa-yel.
"	<i>Leea sambucina</i>	Dhindi, Dindi.
	<i>Syn. Leea staphylea</i>	
18 Sapindaceæ	<i>Hemigyroza canescens</i>	Karpá.
	<i>Syn. Cupania canescens</i> ... }	
	<i>Schleichera trijuga</i>	Kusimb, Kosam ^b , Ko- sham.
19 Anacardiaceæ	<i>Mangifera indica</i>	Ámá (Mango).
20 Connaraceæ	<i>Connarus monocarpus</i>	Sunder.
21 Leguminosæ	<i>Crotalaria Leschenaultii</i>	Dali Dingala.
"	" <i>retusa</i>	Chá-ri.
"	<i>Erythrina indica</i>	Pám-ára, Páramga.
"	<i>Butea frondosa</i> [*]	Palas. Kíákia, the "Flame of the Forest" (Sán-krit, Palása).
"	<i>Flemingia strobilifera</i>	Bondar.
"	<i>Dalbergia latifolia</i>	Sin. Sawa, Sisam, Táli. (Blackwood Tree).
"	" <i>volubilis</i>	Á-á.
"	" <i>paniculata</i>	Pháná.
"	" <i>sympathetica</i>	Pendguli-yel, Yek-yel.
"	<i>Wagatea spicata</i>	Vagáti.
"	<i>Mezoneuron cucullatum</i>	Rági.
"	<i>Cassia fistula</i>	Bábáwa, Garmala. (In- dian Laburnum).
"	<i>Bauhinia racemosa</i>	Apta.
"	" <i>malabarica</i>	Kanchan.
"	<i>Acacia concinna</i>	Chikakai, Shikikai.
"	" <i>Catechu</i> [†]	Kher.

* The leaves of the Palas tree are given as fodder to buffaloes. The flowers are made, with alum, into the yellow dye used at the *Holi* festival (Brandis). This tree gives its name to the memorable plain of *Palasi*, vulgarly called "*Plassey*" (Birdwood's *Vegetable Products*). It yields a *kino* and a *lac*.—(Ib.)

† *Catechu* is manufactured in the Konkan from the wood of the Kher tree.

Natural Order.	Genus and Species.	Vernacular Name.
21 Leguminosæ	<i>Albizzia stipulata</i>	Lullei, Laeli.
"	" <i>amara</i>	Siras (near Alexander Point).
"	<i>Vigna vexillata</i>	Pirambol, Halula (Matheran Sweet Pea).
"	<i>Cylista scariosa</i>	
22 Crassulacæ.....	<i>Bryophyllum calycinum</i> ... } <i>Syn. Kalanchoe pinnata</i> ... }	Pānpue
23 Rhizophoræ	<i>Carallia integrifolia</i>	Phansi.
24 Combretacæ	<i>Terminalia bellerica</i>	Beh-iá, Y-lá.
"	" <i>Chebula</i>	Hirda (Chebulic Myrobolan Tree).
"	" <i>Arjuna</i>	Ain.
"	<i>Combretum ovalifolium</i>	N'á-l-vel.
"	<i>Calycopteris floribunda</i> } <i>Syn. Gattouia floribunda</i> ... }	Bagvel, Yaksbi.
25 Myrtacæ.....	<i>Eugenia Jambolana</i>	Jámbul, Jámbu (the common Jambul tree).
	<i>Syn. Zizygium Jambolanum</i> }	
	<i>Careya arborea</i>	Kumbhá.
26 Melastomacæ.....	<i>Memecylon edule</i>	Arjan (Iron-wood tree).
27 Lythracæ	<i>Lagerstroemia parviflora</i>	Nauh.
"	" <i>flos regina</i>	Taman.
"	<i>Woodfordia floribunda</i> } <i>Syn. Grisea tomentosa</i> ... }	Dhuri.
28. Onagracæ	<i>Ludwigia parviflora</i>	
29 Samydacæ	<i>Casearia graveolens</i>	Bokhárá.
"	" <i>esculenta</i>	Mori.
30 Cucurbitacæ	<i>Trichosanthes palmata</i>	Kaundel.
"	<i>Cucumis trigonus</i>	Kat-vel.
31 Begoniacæ	<i>Begonia crenata</i>	
32 Umbelliferæ	<i>Hydrocotyle asiatica</i> *.....	Brahmi, Karivana, Khopri
"	<i>Peucedanum grande</i>	Báphli.
	<i>Syn. Pastinaca grandia</i> ... }	
33 Loranthacæ	<i>Loranthus involucratu</i>	Bandguli.
"	" <i>loniceroides</i>	
"	" <i>lageniferus</i>	{ Bānda, Vānda
"	" <i>cupreatus</i>	{ (Parasitic plants).
"	" <i>Wallicbianus</i>	
"	<i>Viscum angulatum</i>	(Indian Mistletoe.)
34 Rubiacæ	<i>Mussaenda frondosa</i>	Bbút kes, Sárwad.
"	<i>Randia dumetorum</i>	Gela.
"	<i>Canthium umbellatum</i>	Arsul, Tupa.
"	" <i>angustifolium</i>	Obáp-yel.
"	<i>Vangueria edulis</i>	Alu (Indian Medlar).
"	<i>Ixora nigricans</i>	Lokhandi, Atkura.
"	<i>Pavetta indica</i>	Pháphat, Pápat, Phápti (Matheran Coffee).
"	<i>Adina cordifolia</i> } <i>Syn. Nauclea cordifolia</i> ... }	Hed.
"	<i>Stephegyne parviflora</i>	
	<i>Syn. Nauclea parviflora</i> ... }	Kalam.
35 Compositæ	<i>Vernonia conyzoides</i>	Moti-sadori, Sahadevi.
"	<i>Cyathocline lyrata</i>	Gangotri.
"	<i>Blumea holosericea</i>	Bhamburda.
36 Campanulacæ ...	<i>Lobelia nicotianæfolia</i>	Dháwal, Devnal.

* An infusion of the leaves of this plant was used by the late Dr. Bhau Daji in his treatment of leprosy.

Natural Order.	Genus and Species.	Vernacular Name.
37 Myrsinaceæ	<i>Embelia ferruginea</i>	Ambati.
38 Sapotaceæ	<i>Bassia latifolia</i>	Mohrá, Máwa, Mohá (Mowrah tree).
"	<i>Mimusops Elengi</i>	Bokal, Bakúli (below Simpson Lake).
"	<i>Sideroxylon tomentosum</i> ... } <i>Syn. Sapota tomentosa</i> ... }	Kánta-kúmbal.
39 Ebenaceæ	<i>Dispyros assimilis</i>	Malia (Indian Ebony).
"	<i>Syn. Diospyros nigricans</i> }	Goindn.
"	" <i>Goindu</i>	
40 Oleaceæ	<i>Jasminum arborescens</i> (var. } <i>latifolium</i>)	Kúsar.
"	<i>Olea dioica</i>	Pár-jámbul, Párjám (Wild Olive).
41 Apocynaceæ	<i>Carissa carandas</i>	Karwand, Corinda, (Corinda bush).
"	<i>Holarrhena antidysenterica</i> ...	Kura, Indrajav.
"	<i>Tabernaemontana crispa</i>	Pándhra-kura.
"	<i>Wrightia tinctoria</i>	Kála-kura.
"	<i>Anodendron paniculatum</i>	Lambtáni (Dr. MacDonald's "Seed Traveller").
42 Asclepiadæ	<i>Calotropis gigantea</i>	Rui, Ak, Madár.
"	<i>Gymnema silvestris</i>	Káwali.
"	<i>Hoya pallida</i>	Dudh yel (Wax-plant).
"	<i>Leptadenia reticulata</i>	Khar-khodi.
43 Loganiaceæ	<i>Strychnos colubrina</i>	Kámal, Kájér-vel (near Simpson Lake).
"	" <i>potatorum</i>	Niwali, Nirmali (near Hart Point).
44 Gentianaceæ	<i>Exacum pumilum</i>	Jatáli.
45 Boraginæ	<i>Paracaryum caelestinum</i>	
"	<i>Syn. Cynoglossum coelesti-</i> <i>num</i>	Nechurdi.
46 Convolvulaceæ ...	<i>Argyrea sericea</i>	Gavel.
47 Solanaceæ	<i>Solanum indicum</i>	Chiturti, Bhui-vángi.
48 Bignoniaceæ	<i>Heterophragma Roxburghii</i> ...	Wáras.
"	" <i>adenophyllum</i>	Pádel.
49 Acanthaceæ	<i>Thunbergia fragrans</i>	Eri-yel.
"	<i>Strobilanthes asperimus</i>	Kávi (Indian Wattle).
"	" <i>Heyneanus</i>	Akrá.
"	<i>Blepharis asperima</i>	Pahádi-stgan.
"	<i>Haplanthus verticillaris</i>	Kála-kirát, Kála-ákrs.
"	<i>Barleria strigosa</i>	
"	<i>Var. terminalis</i>	Korants.
"	<i>Barleria courtallica</i>	Itári.
"	<i>Hygrophila serpyllum</i> }	
"	<i>Syn. Physichilus serpyllum</i> }	Rán-tewan.
"	<i>Ecbolium Linneanum</i> }	
"	<i>Syn. Justicia Ecbolium</i> ... }	Dhákta-adulsa.
"	<i>Phayloopsis parviflora</i> }	
"	<i>Syn. Aetheilema reniforme</i> }	Wáiti.
50 Verbenaceæ	<i>Callicarpa lanata</i>	
"	<i>Syn. Callicarpa cana</i>	Yesur, Eshwar.
"	<i>Tectona grandis</i>	Ság, Ságwan (Teak tree).
"	<i>Premna coriacea</i>	
"	<i>Syn. Premna scandens</i> ... }	Chámbar-vel.
"	<i>Gmelina arborea</i>	Shewan.
"	<i>Vitex Negundo</i>	Negud, Nirgundi.

Natural Order.	Genus and Species.	Vernacular Name.
51 Labiatæ	<i>Pogostemon parviflorus</i> } Syn. <i>Pogostemon purpuricaulis</i> }	Pángla, Pángli.*
"	<i>Colebrookia ternifolia</i>	Bháman.
"	<i>Anisomeles Heyniana</i>	Chodhára.
"	<i>Leucas stelligera</i>	Gumá.
52 Chenopodiaceæ ...	<i>Chenopodium ambrosoides</i> ...	Danni.
53 Thymelaceæ.....	<i>Lasiosiphon speciosus</i>	Rametta.
54 Lauraceæ	<i>Machilus glaucescens</i>	Gúlum.
"	<i>Actinodaphne lanceolata</i>	Pishá.
55 Elæagnaceæ	<i>Elæagnus Kologa</i>	Ambulgi.
56 Piperaceæ	<i>Piper silvestris</i>	Dongri-mirchi (Hill Pepper).
57 Euphorbiaceæ ...	<i>Tragia involucrata</i>	Kulti (Sting-nettle Creeper).
"	<i>Macaranga Roxburghii</i>	Chandára.
"	<i>Rottlera tinctoria</i>	Robin, Roen, Kapila.
"	<i>Croton hypoleucos</i>	Pandnrai.
"	" <i>Lawianna</i>	Borambi.
"	<i>Briedelia montana</i>	Asána.
"	<i>Phyllanthus msdraspatana</i> ...	Kanocha.
"	<i>Ceratogynum rhamnoides</i> ...	Chikli.
"	<i>Emblica officinalis</i>	Awala (Gooseberry tree).
"	<i>Glochidion lanceolarium</i>	Bhoms.
"	<i>Fluggea leucopyros</i>	Pándhar-phali.
58 Ulmaceæ	<i>Sponia Wightii</i>	Gol.
59 Urticaceæ	<i>Fleurya interrupta</i>	Khájoti.
"	<i>Gerardina heterophylla</i>	Moti-khájoti, Agia.
60 Moraceæ	<i>Urostigma cordifolium</i>	Pábir.
"	" <i>retusum</i>	Nandruk, Ranekuit.
"	" <i>religiosum</i>	Ashta † (Sanskrit, Ashwath).
"	" <i>infectorum</i>	Kel.
"	" <i>bengalensis</i>	Wad (Banyan tree; 1 e. low Chowk Point.)
"	<i>Covellia glomerata</i>	Umbar (the "Sycamore tree" of the Bible).
"	<i>Ficus heterophylla</i>	Datir.
"	" <i>oppositifolia</i>	Kharoti.
61 Artocarpaceæ.....	<i>Artocarpus integrifolia</i>	Phanas (Jack tree).
62 Gnetaceæ	<i>Gnetum scandens</i>	Umli.
63 Smilacææ	<i>Smilax ovalifolia</i>	Got-vel.
64 Dioscorineæ	<i>Dioscorea pentaphylla</i>	Shend-vel.
"	<i>Dioscorea bulbifera</i>	Karn-kanda, Nor-vel.
65 Liliacææ	<i>Chlorophytum brevicaudum</i>	Kula.
66 Aroidææ	<i>Arisæma Murrayii</i>	Sámpatss-khá, da (Snake-root, the "Cobra Lily").
"	<i>Amorphophallus campanulatus</i>	Suran.
"	<i>Remusatia vivipara</i>	Rokh-álu.

* The leaves of the Pángli are believed in the Konkan to be a cure for snake-bites. A case of an alleged cure was lately brought to the notice of the Revd. Fr. Dreckmann in Bombay. A man had been bitten by a poisonous snake and was said to have recovered after the application to the wound of the leaves and other parts of two plants, which were produced; and one of these was apparently the Pángli.

† The Ashta is distinguished by the Hill-people from the Pipal of the plains, of which it is perhaps a variety.

Natural Order.	Genus and Species.	Vernacular Name.
67 Orchidaceæ	<i>Aerides crispum</i>	Ichwách.
"	" <i>maculosum</i>	
"	<i>Dendrobium barbatulum</i>	Kálábi.
"	" <i>chlorops</i>	
"	<i>Platanthera Susannæ?</i>	
"	<i>Habensia candida</i>	(On the road to the Governor's bund.)
68 Burmanniaceæ ...	<i>Burmannia triflora</i>	
69 Musaceæ	<i>Musa ornata</i>	Rán-kel, Kawadar, Chá-wan-kel (Wild Plantain)
70 Zinziberaceæ	<i>Curcuma Zedoaria</i>	Kachors, Kachole.
"	" <i>pseudo montana</i>	Ráu-haldi (Wild Turmeric).
71 Amaryllidaceæ ...	<i>Pancratium parvum</i>	Khaudálú.
72 Hypoxidaceæ	<i>Curculigo malabarica</i>	Kajuri.
"	" <i>graminifolia</i>	Bherli-már ^o (Fish-tail Palm).
73 Palmæ	<i>Caryota urens</i>	
(Palmæ)		
74 Gramineæ	<i>Coix lachryma</i>	Kasai, Ráu-makai (Job's Tears).
(Grasses)		
"	<i>Bambusa stricta</i>	Váus, Bámbu (Bamboo).
"	<i>Andropogon muricatus</i>	Wals-khaskhas (Khaskhas Grass).
"	<i>Andropogon?</i>	A Grass, with the smell of turpentine, near the Neral Station.
75 Filices	<i>Sagenia coadunata</i>	Kájáryatse Báshing (Indian Beech Fern).
(Ferns)	<i>Syn. Aspidium cicutarium.</i> }	
"	<i>Asplenium planicaule</i>	Brake Fern.
"	<i>Syn. Asplenium laciniatum.</i> }	
"	<i>Pteris aquilina</i>	Hansráj, Rájhas (Goosefoot Maiden-hair Fern).
"	" <i>quadriantha</i>	
"	" <i>pellucida</i>	Pátkuri (Silver Fern).
"	<i>Adiantum lunulatum</i>	
"	<i>Cheilanthes farinosa</i>	Hansráj-yel (Creeping Fern).
"	<i>Lygodium pinnatifidum</i> }	
"	<i>Syn. Lygodium flexuosum.</i> }	Rooting Fern.
"	<i>Polybotya appendiculata</i>	
"	<i>Acrostichum virens</i>	Kadik-pan (Indian Oak Fern).
"	<i>Syn. Pæcilopteris virens, Gymnopteris contaminans.</i> }	
"	<i>Polypodium quercifolium</i> }	
"	<i>Syn. Drynaria quercifolis.</i> }	
76 Lycopodiaceæ	<i>Lycopodium imbricatum</i>	
(Club-mosses)		
77 Musci.	<i>Hypnum curratum</i>	
(Mosses)	" <i>squarrosum</i>	
"	" <i>bryoides</i>	
"	" <i>reflexum</i>	
78 Fungi	<i>Agaricus campestris</i>	Alamben (Mushroom).
"	<i>Lycoperdon pratense</i>	Bhoiphor (Puff Ball).
"	<i>Doedalia gibbosa</i>	Kerambi, Páranza.
"	" <i>versicolor</i>	
"	<i>Polyporus giganteus</i>	

* The long trailing fruit racemes of this Palm are likened by the Hill people to the flowing locks of the long-haired Bheravs, attendants of Shiv: hence the name "Bherli-mar."

INDEX OF VERNACULAR NAMES.

(The references are to the figures in the first column of the Catalogue.)

Agia ...	...	...	59	Chambarvel ...	...	50
Ain ...	...	...	24	Chandara ...	...	57
Ak ...	...	...	42	Chap-yel ...	...	34
Akra ...	...	...	49	Chaura ...	...	11
Alamben ...	...	...	78	Chawan-kel ...	...	69
Alei ...	...	...	21	Cher ...	...	11
Alu ...	...	...	34	Chikakai ...	...	21
Amba ...	...	...	19	Chikli ...	...	57
Ambati ...	...	...	37	Chiturti ...	...	47
Ambulgi ...	...	...	55	Chodhara ...	...	51
Anjan... ..	...	...	26	Chor ...	...	11
Apta ...	...	...	21	Corinda ...	...	41
Arsul ...	...	...	34			
Asana... ..	...	...	57	Danni ...	...	52
Ashta... ..	...	...	60	Datir... ..	...	60
Awala ...	...	...	57	Devnal ...	...	36
				Dhakta-adulsa	...	49
Bagvel ...	...	...	24	Dhakta-karmal	...	2
Bakerli ...	...	...	38	Dhaman ...	...	11
Bahawa ...	...	...	21	Dhauri ...	...	27
Bambu ...	...	...	74	Dhawal ...	...	36
Banda ...	...	...	33	Dhindi }	...	17
Bandguli ...	...	...	ib.	Dindi }	...	21
Baphli ...	...	...	32	Dingala ...	...	56
Behera ...	...	...	24	Dongri-mirchi	...	21
Berki ...	...	...	11	Dyli ...	...	49
Bhaikui ...	...	...	10	Eriyel ...	...	50
Bhaman ...	...	...	51	Eshwar ...	...	46
Bhamburda	...	...	35	Gavel... ..	...	35
Bherli-mar	...	...	73	Gangotri ...	...	21
Bhoiphor ...	...	...	78	Garmala ...	...	34
Bhoma ...	...	...	57	Gela ...	...	21
Bhui-vangi	...	...	47	Ghagri ...	...	16
Bhutkes ...	...	...	34	Ghuti... ..	...	39
Billu ...	...	...	14	Goindu ...	...	58
Biramhol ...	...	...	21	Gol ...	...	10
Bokhara ...	...	...	29	Goldor }	...	63
Bokal ...	...	...	38	Gordar }	...	
Bondar ...	...	...	21	Gotvel ...	...
Borambi ...	...	...	57			
Brahmi ...	...	...	32			

Gulum	...	...	...	54	Kasai	...	...	...	74
Guma	...	...	...	51	Katvel	...	...	...	30
Guti ...	...	...	...	16	Kawadar	...	...	...	69
Halda...	...	...	...	14	Kawali	...	...	...	42
Haldi ...	...	...	...	7	Kel ...	...	...	...	60
Halula	...	...	...	21	Kerambi	...	...	...	78
Hansraj	}	...	...	75	Khavas	...	...	...	10
Hansraj-yel					Khajoti	...	...	...	59
Harkia	...	...	...	7	Khand-alu	...	...	...	71
Harkinjal	...	...	...	3	Khar-khodi	...	...	...	42
Hed ...	...	...	...	34	Kharoti	...	...	...	60
Hirda...	...	...	...	24	Khaskhas	...	...	...	73
Ichwach	...	...	...	67	Khaushi	...	...	...	10
Indrajav	...	...	...	41	Kher ...	...	...	...	21
Itari ...	...	...	...	49	Khopri	...	...	...	32
Jambu }	}	...	...	25	Kokam	...	...	...	7
Jambul					Kolisna	...	...	...	5
Jao ...	...	...	...	6	Koranta	...	...	...	49
Jatali	...	...	...	44	Kaundel	...	...	...	30
Kachola }	}	...	...	69	Kukar	...	...	...	10
Kachora					Kula ...	...	...	...	65
Kadik-pan	...	...	...	75	Kulti...	...	...	...	57
Kajgolitsa-yel	...	...	...	17	Kumbha	...	...	...	25
Kajar-vel	...	...	...	43	Kunti	...	...	...	13
Kajuri	...	...	...	72	Kura...	...	...	...	41
Kalabi	...	...	...	67	Kusar	...	...	...	40
Kalam	...	...	...	34	Kusimb	...	...	...	18
Kala-akra	...	...	...	49	Kutre-vandre	...	...	...	11
Kala-kura	...	...	...	41	Laeli ...	...	...	...	21
Kala-kirat	...	...	...	49	Lahan-tirda	...	...	...	12
Kanal	...	...	...	43	Lahan-bhendi	...	...	...	9
Kanvel	...	...	...	15	Lambtani	...	...	...	41
Kanchan	...	...	...	21	Lokhandi	...	...	16, 34	
Kanocha	...	...	...	57	Lullei	...	...	...	21
Kanta-kumbal	...	...	...	38	Madar	...	...	...	42
Karambel	...	...	...	1	Madvel	...	...	...	24
Kapila	...	...	...	57	Makar-limbu	...	...	...	13
Karai...	...	...	...	10	Malia ...	...	...	...	39
Karu-nimb	...	...	...	13	Mawa }	}	...	...	38
Karu-karanda	...	...	...	64	Moha				
Karvi...	...	...	...	49	Mohra }	}	...	...	1
Kardor }	}	...	...	8	Morvel				
Kardori					Mori ...	...	...	...	29
Karepat	...	...	...	13	Moti-khajoti	...	...	...	59
Karivana	...	...	...	32	Moti-sadori	...	...	...	35
Karpa	...	...	...	18	Moti-yekdi	...	...	...	15
Karwanda	...	...	...	41	Nadena	...	...	...	17
					Nandruk	...	...	...	60

Naram-panal...	...	...	3	Roen }	...	...	...	57
Naneh	...	...	27	Rohin }	...	...	...	66
Necharda	...	...	11	Rokhalu	...	...	...	42
Nechurdi	...	...	45	Rui	...	...	...	50
Negud }	...	...	...	Sag ... }	...	...	...	35
Nirgundi }	...	...	...	Sagwan }	...	...	...	10
Nirmali }	...	...	...	Sahadevi	...	...	...	66
Niwali }	...	...	34	Saldhawal	...	...	...	12
Padel...	...	...	48	Sampatsa-khanda	...	...	...	34
Pahadi-atgan	...	...	49	Sanmukh-patri	...	...	...	64
Pahir...	...	...	60	Sarwad	...	...	...	50
Palas ...	...	...	21	Shendvel	...	...	...	21
Pandharphali	...	...	57	Shewan	...	...	...	ib.
Pandhra-kura	...	...	41	Shikekai	...	...	...	20
Pandri	...	...	13	Sisam }	...	...	...	66
Pandurai	...	...	57	Sisu ... }	...	...	...	9
Pangara	...	...	21	Sundar	...	...	...	27
Pangla }	...	...	...	Suran	...	...	...	4
Pangli }	...	...	51	Tamri-sawar...	...	...	...	21
Panphue	...	...	22	Taman	...	...	...	17
Papat...	...	...	34	Tan ...	...	...	...	12
Paramga	...	...	21	Tali ...	...	...	...	16
Paranza	...	...	78	Telitsa-yel	...	...	...	34
Par-jam }	...	...	...	Tirda	...	...	...	60
Par-jambul }	...	...	40	Toran	...	...	...	62
Par-yel	...	...	4	Tnpa ...	...	...	...	21
Patknri	...	...	75	Umbar	...	...	...	33
Pendguli-yel	...	...	21	Umli ...	...	...	...	74
Phanas	...	...	61	Vagati	...	...	...	4
Phansa	...	...	21	Vanda	...	...	...	24
Phansi }	...	...	...	Vans ...	...	...	...	15
Phaphat }	...	...	23	Vasanvel }	...	...	...	21
Phapti	...	...	34	Vatoli }	...	...	...	50
Pisha ...	...	...	54	Vat-yel }	...	...	...	49
Polara	...	...	14	Waiti	...	...	...	74
Ragi ...	...	...	21	Wala ...	...	...	...	48
Rajhans	...	...	75	Waras	...	...	...	24
Rametta	...	...	53	Yakshi	...	...	...	15
Ran-bhendi	...	...	9	Yekdi	...	...	...	21
Ran-haldi	...	...	70	Yek-yel	...	...	...	15
Ranjai	...	...	1	Yevti	...	...	...	50
Ran-kel	...	...	69	Yesnr...	...	...	...
Ran-makai	...	...	74					
Ran-tewan	...	...	49					
Ran-tuer	...	...	21					
Ratamba	...	...	7					

A LIST OF THE BUTTERFLIES OF THE BOMBAY PRESIDENCY IN THE SOCIETY'S COLLECTION.

WITH NOTES BY E. H. AITKEN.

THE two following species were omitted by me in the first part of this paper which appeared in July. I have nothing to note about either of them:—

39. *Mycalesis mineus*.—There is a single specimen in the collection, without locality.

40. *Ypthima singala*.—This also is without note of locality. The Society's collection is rather weak in *Satyrinæ*.

I find that I also omitted to mention that in Bombay I have found the larva of *Junonia limonias* on *Barleria prionitis*, a near ally of *Asteracantha longifolia*, the favourite food of *J. almana*.

I will now proceed with my list.

LEMONIDÆ.

41. *Abisara fraterna*.—When the rainy season is drawing to a close, in September or October, every bush on the hills is enlivened by the attitudes and frolics of this little embodiment of vanity. In all its ways it is unique, perching in the middle of a leaf, on the upper side, with wings half open, turning jerkily from one side to another, then hopping to another leaf and strutting round it. Sometimes a pair join in these performances. It is one of the easiest Butterflies to catch, having no fear. I have found it in Poona, but rarely, if ever, in Bombay, though it is common in the low jungles of the Tanna District.

LYCÆNIDÆ.

I divide the *Lycænidae* by form and habits into two strongly contrasted tribes; the one, robust in body and brilliant in colour, swift and wary, given to basking on high trees, may be illustrated by such genera as *Virathola* and *Tajuria*; the other, a feeble folk, without character, flitting mostly near the ground, or resting on low bushes with their wings very slightly opened, includes such genera as *Catochrysops*, *Polyommatus*, *Zizera*, and their kindred. The former have the thorax very stout, few Butterflies comparing with them in this respect, except the species of *Charaxes* and some *Hesperidæ*; but they pass gradually into the weaker forms through such genera as *Aphnæus*, and, as I do not propose to be the founder of a new classification, I will merely place the genera in such order as seems best to illustrate my idea.

42. *Anops phædrus*.—This little gem, though nowhere plentiful, may be met with in every part of the Presidency. It appears after, or perhaps before, the end of the monsoon, and remains till the end of the year. In the afternoon, when most other Butterflies have retired to rest, it loves to bask in the sun on a small tree or high bush, with wings just a little open.

43. *Baspa melampus*.—I have not often caught this, which is rarer than the last, and have seen it too seldom to form an opinion on the regular time of its appearance. It has the same habits as the last.

44. *Tajuria longinus*.—This also is comparatively scarce, but occurs, I think, almost everywhere.

45. *Irasta marinas*.—I do not think I ever caught with my own hands this most splendid, surely, of all the Lycaenidæ, and I doubt if it occurs in Bombay. The specimens in the Society's collection are all, I think, from the Tanna or Nasik District, and I have met with it myself at Egut-pura on the Thull Ghât, where it began to appear in October or November.

46. *Virachola isocrates*.—It is almost impossible with the net to get a really good specimen of this or the next. They are not only difficult to catch, being exceedingly swift, wary, and given to settling on high trees, but, when caught, difficult to secure without injury. There is a delicate bloom on a fresh specimen which the gentlest touch destroys. It is easily reared however. As is well known, the larva feeds inside the fruit of the pomegranate and, some time before becoming a pupa, eats its way through the tough rind and fastens the fruit with silk to its stalk, thus preventing it falling off in case it should wither before the Butterfly escapes, as it generally does. This operation is performed at night, and generally repeated night after night. I have taken a pomegranate infested with these larvæ (several usually inhabit each fruit) and made it stand in an egg-cup; in the morning it was so securely fastened that in taking up the fruit I lifted the cup. Of all animal instincts that I have seen or heard of, this is one of the most astonishing and certainly the most difficult to reconcile with any theory of development. As far as I have observed it, the larva never leaves its shelter except for the definite purpose so necessary to its safety, and it taxes ordinary ingenuity to suggest any possible conditions under which some larvæ might have performed the act in the first instance without purpose. I have found this Butterfly pretty common in Bombay and Poona from December or January till March at least.

47. *V. perse*.—I do not think I have met with this except on the hills, where it is common, appearing in December when the fruit of the Ghela (*Randia dumetorum*), on which the larva feeds, is ripening, and remaining till March or April. The larva has the same curious instinct as the last species and needs it more, for the Ghela fruit withers at once when attacked and would inevitably fall before its tenant had reached the pupa state if not artificially supported. I have found only one larva in each fruit, and have sometimes noticed ants going in and out of the hole made by it, for what purpose I cannot say. The stony hardness of the fruit turns the edge of one's penknife and of one's curiosity too. This Butterfly has the habit of taking its station, during the hottest hours of the day, on

a particular leaf, from which it darts out in pursuit of every other Butterfly that passes by. This habit characterises a few brilliant genera in families widely different. It is strong in Charaxes.

48. *Nilasera amantis*.—This is not common, and I am not sure of the limits of its season. I have seen it oftener about the beginning of June than at any other time, and oftener at Karanja across the Bombay Harbour than at any other place. It flies very fast.

49. *Aphnæus* (or *Spindasis*) *vulcanus*.—This species is not to be met with in Bombay gardens; but in the Deccan it is not rare, and on Karanja I have found it abundant in the hot season. I think it rarely opens its wings, except to fly.

50. *A. acamas*.—Mr. Newnham sent specimens of this from Bhooj.

51. *A. trifurcata*.—These are without note of locality, and I know nothing of them.

52. *A. elima*.—These are without note of locality and I know nothing of them.

53. *Catapæcilma elegans*.—A single specimen of this was caught by Mr. R. C. Wroughton at Bassein in the Tanna District last March or April.

54. *Rahinda amor*.—This occurs almost everywhere, but is common, nowhere. It appears at the close of the rainy season. It is fond of taking its stand on the point of a prominent leaf, with wings closed and an air of decision not easy to describe. *Spindasis* has the same habit.

55. *Jamides bochus*.—This is not uncommon in Bombay and the surrounding country, and also in Poona, chiefly, I think, after the monsoon, but I have no notes.

56. *Tarucus theophrastus*.—Common both in Bombay and the Deccan after the rains. Specimens vary much in size and in the intensity of the spots on the under side. The larva feeds on the tender leaves of the Beyr or Bor tree (*Zizyphus jujuba*).

57. *T. plinius*.—This is not so common as the last, but not rare coming out at the same season. I have found the larva on *Sesbania aculeata*, an annual which springs up everywhere in Bombay during the rains and shoots up to a height of 6 or 7 feet and withers away in October. Its fragile leaves wither up a few minutes after being plucked, and it is no easy matter to rear a minute larva on them. I was successful with only one. I find it described in my notes as green and of the usual wood-louse form, with a dorsal ridge of small protuberances. The pupa, which came out in seven days, was greenish, smooth, not $\frac{1}{4}$ th of an inch long, and closely attached to the bottom of the pill-box in which it was kept.

58. *Castalius rosimon*.—Very common from August to the end of the year at least, alike on the hills and the plains. It settles much on the ground.

59. *C. decidea*.—I believe, but am not quite certain, that I have caught this in Bombay. It is not uncommon on the hills.

60. *Talicada nyseus*.—This peculiarly distributed insect is not found at all in Bombay, nor do I recollect once meeting with it at Khandalla, Matheran, or Egutpura; but in a particular spot at Mahableshwar it was swarming last March, and I have a faint recollection of its being equally abundant at the hill forts of Singhur and Poorundhur near Poona, while at Poona itself it is never wanting during the dry months. Mr. H. Wise informs me that in Kanara he finds it at an elevation of 1,500 feet. It lies very low and settles much on the ground, wings always closed.

61. *Lycaenesthes lycaenina*.—There is one specimen, a male, in the collection, without note of locality. I have a strong impression that I myself caught it in Bombay and forgot to label it at the time.

62. *Lampides celianus*.—This is not confined to the hills, but decidedly more abundant there than on the plains. About Christmas there is no insect more abundant at Khandalla.

63. *Catochrysops cnejus*.—This is very common everywhere after the monsoon. There is little to note about these commoner Lycaenidæ. They are very much alike in their ways, flying low and often basking with their hind wings more expanded than their fore wings, a habit which they share with some of the Hesperidæ. Some of them have also the curious habit of rubbing their hind wings against each other.

64. *C. strabo*.—This appears also after the monsoon, about August, but is not so common in Bombay, I think, as the last.

65. *Polyommatus boeticus*.—This is common everywhere.

66. *Chilades varunana*.—There are five specimens in the collection without note of locality, but certainly from the Tanna or Nasik District I know nothing about it.

67. *Pathalia albidisca*.—There are a few specimens from different parts of the Presidency.

68. *Azanus crameri*.—A single specimen without note of locality.

69. *Spalgus epius*.—I have found this on Karanja in February, August, and September, but it is not common.

70. *Zizera karsandra*.—I find myself obliged, with shame, to confess that I am not quite sure whether this is the species which swarms all over the Esplanade in Bombay some time after the rains. I assumed that I knew it, and now, when a doubt has arisen in my mind, I am no longer in Bombay. It can scarcely however be any other species.

71. *Z. pygmaea*.—This is a Bombay species too, but not so abundant.

72. *Z. ossa*.—This has been described by Colonel Swinhoe for the first time in the paper which I have already referred to. It is not by any means uncommon.

ZOOLOGICAL NOTES.

NOTE ON THE *HOMALOPSIDÆ* IN THE SOCIETY'S COLLECTION.

BY MR. JAMES A. MURRAY, *Curator, Karachi Museum.*

IN August last I had the pleasure of examining a good part of the Society's collection of reptiles, and among them the specimens (six in number) of the Homalopsidæ, described in No. I of the Society's Journal by the Rev. F. Dreckmann. The specimens were correctly referred to the Homalopsidæ, but were not assigned to any group evidently owing to the difference in the number of scales round the body. The other characters agreed quite with those of the genus *Ferania*, and I had no hesitation in identifying the specimens as *Ferania Sieboldi*, (Schbg.,) on finding that the specific characters of the only species known also agreed. When Dr. Gray founded the genus *Ferania* (*Zool. Misc.*, p. 67), he had but a single specimen from Province Wellesley in Bengal, and one with only twenty-seven series of scales round the body. Lieutenant Barnes has done good service in unearthing several more specimens, and thus being the means of bringing about an amendment of the generic characters of one of the four genera, constituting the group of Homalopsidæ, having no nasal appendage and more than five upper labials. The generic characters of *Ferania*, as now amended, will shortly stand as under :—

Snout without appendage; more than five upper labials; *two* anterior frontals; scales in 27—31 series.

One species, *F. Sieboldi*, (Schbg.,) characters as described in Gunther's *Reptiles of British India*, p. 284; scales in 27—31 series.

J. A. M.

LIST OF BUTTERFLIES RECEIVED FROM MAJOR YERBURY,
CAMPBELLPUR, PUNJAB.

5	<i>Hipparchia parisatis</i>	2	<i>C. sareptensis</i> .
2	<i>Aulocera swaha</i> .	3	<i>Euchloe lucilla</i> .
1	<i>A. saraswati</i> .	2	<i>Mancipium canidium</i> .
2	<i>Amecera schakra</i> .	3	<i>M. nipalensis</i> .
1	<i>Callerebia daksha</i> .	2	<i>Catopsilia pyranthe</i> .
2	<i>Ypthima asterope</i> .	2	<i>Teracolus faustus</i> .
2	<i>Y. bolanica</i> .	1	<i>T. fimbriata</i> .
2	<i>Y. nareda</i> .	5	<i>T. protracta</i> .
1	<i>Danais limniace</i> .	1	<i>T. etrida</i> .
1	<i>Vanessa cashmiriensis</i> .	2	<i>Deudorix epijarbas</i> .
2	<i>Junonia asterie</i> .	1	<i>Baspa nissa</i> .
1	<i>J. orithyia</i> .	6	<i>Spindasis acamas</i> .
1	<i>Argynnis niphe</i> .	3	<i>Catochrysops cnejus</i> .
1	<i>A. lathonia</i> .	1	<i>Tarucus nara</i> .
4	<i>M. Robertsii</i> .	1	<i>Lycæna putli</i> .
2	<i>Libythea lepita</i> .	3	<i>Zizera maha</i> .
2	<i>Dodona durga</i> .	2	<i>Z. trochilus</i> .
1	<i>Papilio erithonius</i> .	1	<i>Chrysophanus phlæas</i> .
1	<i>Belenois mesentina</i> .	1	<i>Hesperia evanidus</i> .
2	<i>Gonypterix nipalensis</i> .	5	<i>Gegenes karsana</i> .
5	<i>Colias Fieldii</i> .		

NOTE ON THE CONDUCT OF A TAME PIGEON.

By E. H. AITKEN.

THE curious example of conjugal infidelity among pigeons given by Mr. Hart in the last number of the *Journal* reminded me of two incidents, illustrating the characters of the same birds as husbands and fathers, which may interest members. By way of parenthetical preface, I will say that, if the *Journal* of the Bombay Natural History Society awakens a livelier interest in the behaviour of animals as intelligent beings, it will do a valuable work.

In 1879 a baby pigeon, not more than a week old, in one of the nests in my pigeon-house, was left an orphan by the sudden death of its mother. It was too young to be fed by hand and I supposed it must die, but I was mistaken. The bereaved father, instead of giving himself up to sorrow, at once took sole charge of his helpless offspring and reared it successfully. He had not sense to make any change in his habits. Among pigeons the female sits alone on the nest, except for three or four hours in the middle of the day, when she is relieved by the male; so this bird went in every day, about 10 or 11 o'clock, and kept the nest warm till 2; but all night he slept as he had been accustomed to do, in another chamber, leaving his naked little child exposed to the cold of a February night. It survived however and was doubtless all the hardier for its Spartan nurture.

Whether this parent's conduct is attributed to intelligence or stupidity will depend upon the direction in which we have accustomed our feelings to run; but there can be no question about the following case. In my flock there was one old male bird who was quite a character in the community. He was a fat easy-going, good-natured bird, but pampered and self-indulgent to an uncommon degree. It was a favourite sport of mine to fit him into the mouth of a stone jar, like a cork, only his head and shoulders out, and in that position to give him grain, which he would eat with the most composed enjoyment. His wife was a blue rock with all the strong instincts and affections of a wild bird. Finding her always willing to take more than her share of the family cares he shirked his and, during the hot season, gave up taking his turn on the nest altogether leaving her to sit day and night, which she did, excepting a very short interval which she allowed herself for food. When the cold season came round, he found his opportunity to repay her by taking all the night work duty on himself. He actually turned her off the eggs and slept in the nest himself, while she roosted at the entrance and kept out the cold air!

E. H. A.

NOTE ON *DANAIS DORIPPUS*.

By MR. A. T. H. NEWNHAM, S. C., 10TH N. I.

MR. AITKEN mentions in his paper on Bombay Butterflies that he has never met with this variety, but in the last month I have seen here, in Cutch, two specimens, one of which I added to my collection. Besides these, another collector obtained two more at Mandvie, and said he had seen others which escaped him. Also the same collector had caught the variety known as *D. alcippoides*, but having the lower half of the hind wings pale lavender seaintd of white.

A. T. H. N.

NOTE ON LOCALITY.

BY MR. A. T. H. NEWNHAM, S. C., 10TH N. I.

EXTRAORDINARY COINCIDENCE.—During a recent visit to Ceylon I happened to go again to a certain spit of shingle on which I had a month previously found several eggs of *Sterna melanogaster*. I was again successful in finding two eggs of the above-mentioned bird, and on lifting the eggs up to deposit them in cotton-wool, my eye was caught by something glittering on the spot from which I had just removed the eggs. On picking it up, I found it to be an "entomological pin," and presumably one which I dropped when I was there before, as it is in the highest degree improbable that any one else would have had entomological pins in such an out-of-the-way place. The question arises, was it a mere coincidence that the Tern laid its eggs on that very spot, or was it attracted by the glittering appearance of the pin?

The Bower-bird of Australia, I believe, collects gaily-coloured and glittering objects and places them round about its nest. Could then this Tern have been actuated by some similar freak, and have brought the pin from some place where it had found it?

A. T. H. N.

NOTE ON THE BREEDING OF *PARRA INDICA*.

BY LIEUT. H. EDWIN BARNES.

MR. HUME in his *Nests and Eggs of Indian Birds* lays stress upon the alleged fact that the Bronze-winged Jacana lays a much greater number of eggs than its nearest Indian ally, the Pheasant-tailed Jacana (*Hydrophasianus chirurgus*).

At page 591 of the above-quoted work, Mr. Hume writes:—"Of six nests examined, none contained more than *seven*, but the boatmen averred that the birds, sometimes at any rate, laid *ten*."

Again, on the next page, quoting from Mr. R. Blewitt's experiences in the Jabulpur, Saugor, and Jhansi Districts, he writes:—"The regular number of eggs I have not been able to ascertain accurately, but from *eight* to *ten* may be taken as the maximum number."

I have had opportunities of examining great numbers of these nests *in situ*, and I have never yet found more than *four* eggs in any one of them, although many have been in an advanced stage of incubation; the fishermen, too, assert that four is the number invariably laid. I cannot help suspecting that some mistake has occurred. I actually took with my own hands over two hundred eggs, on four different dates, in August and September 1880, from jheels in the vicinity of Neemuch, and I have taken at least fifty eggs from the Saugor and Chundrapur Lakes this season, and had I wished, could easily have taken four times as many. The Saugor Lake is within half a mile of my bungalow, and is much frequented by these birds, and as I am continually boating and fishing upon it, I have exceptional opportunities of noting facts in reference to their habits and nidification.

I cannot help coming to the conclusion that four is the normal number of eggs laid by this bird, and that whenever a greater number has been found, it is the joint production of two or more birds.

I do not remember seeing the fact noticed anywhere that these birds often deposit their eggs on a heap of floating weeds without preparing any nest at all.

It would be interesting if other zoologists would state if their experiences coincide with mine or not.

H. E. B.

NOTE ON REVERSION TO PRIMITIVE TYPES.

BY R. A. STERNDALÉ.

I HAVE mentioned in the *Mammalia of India*, quoting from a writer in the *India Sporting Review*, a case of cross-breeding between jackals and dogs, in which in the third generation, or one-eighth jackal and seven-eighths dog, three out of five pups had gone back to the jackal type. I have since then been noticing cases of reversion in domestic cats. We have an English, or rather Scotch, black cat which we brought out from home three years ago. Her first kittens in India were all white, with patches of the usual Indian grey or Indian tabby, which consists of small spots in lines on a grey ground. We destroyed all except two, a son and daughter, the latter a very pretty cat, with decidedly English points about her: this cat, in her third family of the usual grey-and-white kind, had one very handsome tabby kitten, which, with a white one, was kept. Now this tabby kitten, who was named, "Joe," because like Dickens' fat boy, he was always sleepy, afterwards softened into "Joey," turned out a true English tabby, a type I have never seen in India (*see* the sketch I have given of him in this journal), and a tabby of a very handsome kind, unusually so. Were he to escape in suitable jungles and be shot, he would probably, but for his tail, be identified as *Felis marmorata*, for he is nearer in colouring to that species than any domestic cat I have come across. Even pure English tabbies have, like their remote ancestor the wild cat (*Felis catus*), certain stripes down the sides, but Joey, with the exception of the bars on his limbs, is clouded like the Rimaudaban (*Felis diardi*), or the smaller marbled cat (*F. marmorata*). English tabbies do occasionally have their side markings in irregular concentric circles, but the colour of the ground-work is generally grey instead of sandy fulvous. However I take it that Joey gets his Joseph's coat of many colours from his English ancestor and not from his Asiatic grandfather. He is a queer-tempered cat, shy with most people, although his sisters and his cousins and his aunts will go to anybody; but he is devoted to me, and at times will not leave me for a moment. Lately, whilst laid up with the fever which has delayed the issue of this journal, I had to keep to bed for a day or two and Joey never left my side, and his meals had to be brought into my room.

Now to go back to Joey's grandmother, the old black Scotch cat. For two years-and-a-half she had a constant succession of grey-and-white kittens between twenty and thirty, and we wondered why none of her children resembled her. Lately however, out of a batch of five, three were jet black.

Her eldest daughter (Purry) had lately five kittens, of which one was jet black and two others partly so; but it is only recently that this colour has begun to shew itself: of some thirty or forty preceding kittens, only two had a few black patches—now blackies are getting common.

I forgot to state that Joey's markings are perfectly symmetrical, each side being alike. As you hold him up with his back towards you, the pattern runs off on each side from the central stripes as evenly as if they had been marked off with compasses, which is characteristic of the feræ.

R. A. S.

SOME NOTES ON ABNORMALITIES IN THE HORNS OF RUMINANTS.

BY MR. J. D. INVERARITY.

THE most curious instance of abnormal horns I have met with was an old stag samber I shot some years ago near the Taptee. His right horn was 36 inches long and nothing peculiar about it. The left horn was a few inches shorter, and had no brow antler at all nor the slightest rudiment of one. About three-quarters of an inch from the left horn was a third horn, a mere knot but growing on a *separate bony pedicle of its own*. It was entirely distinct from the main horn, the skin covering the intervening space. No sign of disease or injury to any of the organs.

SINGLE SAMBER HORN (Sketch No. 1).—A very massive heavy horn. Either shed or killed by tiger. I think the latter. The horn had the appearance of having dripped over all round the burr and hung down in what, for a better term, I will describe as numerous icicles. This horn, for months after I picked it up, sweated some oily matter of a most offensive odour.

FOUR-HORNED ANTELOPE.—The bony core curves inwards of one horn. Had anterior horns, but I have lost them.

WILD COW-BUFFALO.—Right horn normal, about 3 feet long; left horn not more than 18 inches long, probably less, growing almost straight down close to the cheek and turning backwards. I was close to her for several minutes and observed it well, but did not fire at her. The misshaped horn appeared much thinner and smoother than the other one. The end *was blunt*.

There is a curious malformed cow-bison's head in the Madras Museum, of which you might get a sketch.

I have in my possession in Scotland a small samber head the left horn of which bends down, forming a club close to the skull just like the horn of the Cashmere stag pictured No. 2. This club shape is the natural shape of deer's horns while growing. Any one who has seen stags while their horns are growing, before they have reached the point where the upper tines branch out, will corroborate me that the top of the horn is then club-shaped. The Cashmere stag No. 2 and the small head I am speaking of have had their growth arrested at this stage.

DOE CHINKARA.—I have never shot one, but I think their horns are frequently misshapen. One I have a note of had one horn bent forward and the other backwards, but having omitted to take a drawing of it my note is not sufficiently full to enable me to give a more accurate description.

See too the curious bison head of mine, shot in 1885, in the Society's Rooms. The bony core being only a few inches long, there was nothing to give the usual bend to the horns, which have accordingly grown straight out and curved forward. This was a very old cow, the incisor teeth being worn level with the gums—a thing I have never seen before. I shot her by a fortunate accident. There were a lot of three bison. I noticed something peculiar about the head during the stalk, but did not see what the real state of the case was. Firing at the large bull, I broke his shoulder. The second barrel was intended for the bull, but the cow rushed alongside as I pressed the trigger and got the bullet in the neck, dropping dead.

I also send for inspection a small sambar head. I am not sure whether the right horn has ever had a brow antler. There has been a fracture of some sort. Whether the brow antler has been broken off and the fracture worn smooth, or, as I am induced to think from there being no fracture visible on the inside of the horn, that there was no brow antler, is doubtful. If the latter is the case, the long brow antler (for the size of head) of the left horn is remarkable.

PTEROPUS EDWARDSI.

I saw on 9th May this year at Nara, on the banks of the Jouk River, a number of Flying-foxes fanning themselves in the way described by Mr. Aitken. The fauners however were only about 10 per cent. of the population.

J. D. I.

Editor's note on above.—Mr. Inverarity was kind enough to send me the above notes to help me in a continuation of my previous paper on horns; but ill-health has prevented my taking up the subject more fully this time so I have published his notes without any addition of my own. I have copied his sketch of the very curious sambar horn he picked up; and have also to thank him for the loan of a book on sport in Madras by "the Old Shikarry" (G. A. R. D.), in which is a photograph of a cheetal's head with an abnormal bez-tine of extraordinary length. I have taken the liberty of copying this, and it forms No. 2 sketch in the accompanying plate.

R. A. S.

NEOMERIS KURRACHIENSIS.—(Murray).—The following description of the Porpoise, mentioned in the paper on the *Waters of Western India*, page 159, of which I have given an illustration, has been sent to me by Mr. Murray, and is in fact a draft of his paper on the subject in the *Ann. and Mag. Nat. History*, Vol. XIII., 1884. It will interest our readers and supplement KESWAL'S description.

R. A. S.

"A cetacean of the family Delphinidæ, which I shall describe under the name *Neomeris kurrachiensis*. The characters of the genus are:—Dorsal fin none; nose of skull short, rounded in front, flat and shelving above; teeth numerous, compressed, nicked, acute, extending nearly the whole length of the jaw (Gray, 'Seals and Whales', &c.).

"*Neomeris phocaenoides* is the only species of the genus, and its dentition is given as $\frac{1}{12}$ (*Delphinus melas*) or $\frac{2}{12}$ on each side. The species

under notice has $\frac{1\frac{3}{8}}$ on each side, and there are besides a set of $\frac{3}{2}$ which were scarcely visible through the gums, and situated out of the line of the other teeth in front of the jaws. In shape these $\frac{3}{2}$ teeth are quite unlike the rest, being conical instead of flattened or compressed. The measurements of the animal taken in the flesh are as under :—

	Inches.
Length along curve from tip of snout to notch between caudal flukes	52
Ditto straight	45
Tip of snout to pectoral fin	10
Caudal flukes	9 × 3
Distance of blow-hole from tip of snout along curve	6·5
Ditto from angle of mouth to eye.....	1·62
Vent from root of caudal fin	14

Snout rounded; head very convex, rising posteriorly high to the dorsal surface; blow-hole semi-lunar; back with a longitudinal band of spinous tubercles on the vertebral area, beginning nearly opposite the root of the pectoral, widening to 1·5 inch about the middle, and again contracting and ending narrowly opposite or in line with the vent; no dorsal fin; pectoral subfalcate; teeth $\frac{1\frac{3}{8}}$; colour shining black throughout, except a purplish red path in front of the snout (on the upper lip) and on the throat; intestine 31 feet in length; contents of stomach Crustacea (species of *Penaeus*).

	Inches.
Length of skull over curves to upper edge of foramen magnum	10
Ditto straight from below.....	8
Height of skull (vertex of super-occipital).....	4·25
Tip of snout to blow-hole	4·25
Ditto to interparietal.....	6·25
Interparietal to upper edge of foramen magnum.....	3·75
Across maxillaries.....	4·75
Across blow-hole.....	1·5
Length of molar.....	2 0
Ditto of brain cavity	4·0
Greatest space between occipital condyles (upper).....	1·5
Across paroccipitals	3·37
Smallest space between occipital condyles at lower third.....	1·0
Vertical diameter of foramen magnum	1·75
Breadth across last teeth on each side (upper jaw)	2·5
Ditto ditto (lower jaw)	2·5
Teeth-line in upper and lower jaw	2·5
Length of lower jaw to coronoid process	5·62
Greatest vertical depth of ramus	2·62
Palate	4·0

The super-occipital is sub-globular and very convex above; rostrum short, rounded in front; foramen magnum vertically oval, with the occipital

condyles vertically elongated and convex, wider at their lower third; teeth small, flattened or compressed, with a sharp sub-crescentic crown, faintly nicked, and with the middle of their outer and inner sides slightly swelled; they are rather obliquely arranged in line, about one-fifth of each succeeding hinder one overlapping its fellow, but not in contact.

BOTANICAL NOTES.

NOTE ON THE *GLORIOSA SUPERBA* (N. O. *LILIACEA*), "SUPERB LILY."

BY MR. FRANK ROSE, P. W. D.

SEVERAL writers have pronounced the *root* of this handsome climbing plant a *violent poison*, and next to the Wild Aconite (*Aconitum ferox*). I much doubt the assertion, as I have seen *Brinjaris* using it for medicinal purposes, and it doubtless has active properties. Native Surgeon Mohideen Sheriff (Madras) has already removed the doubts expressed by certain of the Medical Faculty by giving it to his patients, and has himself taken "12-grain doses *three times a day*." In case an experiment may be wished to be tried, I send you by this day's post the tuberous root of this shrub obtained from my garden.

Florists should not lose this opportunity of collecting the roots for next rains. This ornamental plant flowers early in August, lasting only eleven days: the petals open with a light green tint, and then gradually assume the crimson and yellow on the sixth day, when it is then clad in its richest and gayest colour, after which the whole flower becomes crimson and then fades.

This perennial plant is easily identified. The *root* is bulbous; *stem*, green herbaceous; *leaves*, lanceolate, ending with tendrils or cirrhiferous; *calyx*, nil; and *corolla*, reflex, 6-petalled; *habitat*, fields and forests. *Willdenow* is said to have discovered this shrub in 1690. The Indian synonyms are *Nag-dhan* or *Nat-kabachnag* derived from the Wild Aconite; *Olot-chandal*, Bengali; and *Kalaiypak-kirhangu*, Tamil. In *Balfour's Botany* (Ed. 1854) nothing is said about this plant.

F. R.

NOTE ON THE *GLORIOSA SUPERBA*.

BY SURGEON K. R. KIRTIKAR.

WITH reference Mr. Rose's remarks, I may at once state that I am not personally able to bear testimony to the violently poisonous qualities of the root of *Gloriosa superba*. I have neither used it medicinally, nor have I seen any cases of men poisoned by it. Dr. Normau Chevera however, in his work on Indian Medical Jurisprudence, mentions two fatal cases (pp. 284-285) in Edition of 1870, and attributes to the root narcotico-irritant

properties. Gribble in his recent work on Indian Medical Jurisprudence is silent on the point.

In his *Forest Flora of British Burmah* (Vol. II., p. 542), Kurz says:—"The Phoongyees often collect the poisonous roots of *Gloriosa* for medicinal purposes." Sir George Birdwood, in his *Bombay Vegetable Products*, says it was first described by Hermann. It is said to be a substitute for Colchicum. In Bapu Gangadhar Joshi's *Nighanta Prakāsh*, based on various Sanskrit works on the use and properties of indigenous drugs, the plant is called "Kalikāri," "Kalalāvi," or "Khadiyānāg." It is said to be destructive of biliousness, pruritus, oedema, intense thirst, colic, &c. It is therefore not unknown as a remedial agent. It is said to be abortive also. It is deserving of a trial as tonic and alterative, especially as Mohideen Sheriff finds it useful in his own practice.

K. R. K.

USES OF THE FLOWER OF *PANDANUS ODORATISSIMUS*.

BY MR. FRANK ROSE, P. W. D.

IN forwarding for identification two samples of the extract from the flower of this tree, known as the "Attar of Keura" and the "Water" (*Kevada-kā-aaraq*) manufactured last year at Aurangabad, Deccan, but which have lost, to a certain extent, their aromatic properties from length of time, and with reference to the very interesting paper on the uses of the tree by Mr. R. A. Sterndale, F.R.G.S. (Journal No. II. for April), I am induced to follow up Dr. Kirtikar's "Notes," and say a few words anent the uses of this schlamydeous flower.

THE FLOWER is certainly of a very fragrant nature, more powerful than any of the Indian Flora, and its perfume is considered to be the richest by the Mahomedan community. The flowers are used for a double purposes viz., scenting wearing apparel and keeping away insects, especially the cock-roaches (*Blatta. orientalis*).

PERFUMERY.—The *Aaraq*, or water, is issued extensively by the well-to-do of the Mahomedan class, chiefly in flavouring their drinking-water during the hot-weather by adding a few drops to it. Although it may be palatable to some Europeans in their beverages, confectioneries, *et hoc genus omne*, I am no advocate for it; but tastes differ, hence my reason for sending a sample for trial.

The *Attar* is prized as much by the Native community as any of Piesse and Lubin's perfumes are by Europeans. A superior kind of *Attar* is exported from Northern India.

SYNONYM.—A respected botanist says that the word *Pandanus* has its derivation from *Pandang* (Mslay name of the genus), signifying "Regard," owing to "the beauty of the tree and its exquisite odour." Daniel Olliver, F.R.S., F.L.S., says that the "Screw-pine" derives its appellation from the Pine-apple order (Bromeliacæ) owing to the similarity of their foliage. It is also known as the "Calders Bush" and "Screw-palm," and in Mauritius as the "Variquois Plant." The plant was first recognized in India in 1771 by that great German botanist Willdenow. I find that

Mahadeva (q. v., "Hindu Theatre"—*Malati* and *Mahadeva*) is reported to have sung the praises of the *Kitaki* (Sanskrit) in the following strains :—

"Faint in the East the gentle moonlight gleams
 "Pale as the Palm's sear leaf, and through the air
 "The slowly rising breezes spread around
 "The grateful fragrance of the *Kitaki*."

In Burmah the plant is known as *Sasava* and in Madras as *Tazhancheddi*.

HABITAT.—This tree I have seen growing in Southern India and in H. H. the Nizam's dominions: common in the vicinity of Aurangahad, Deccan. Having an excellent fibre, I am surprised that it is not cared for and utilized for rope-making in the Nizam's territory; but, if so, it must be to a very limited extent; the fibre could be more profitably used also in manufacturing paper. The Japanese cultivate the plant extensively for its odoriferous nature; similarly Burmah, where the tree grows wild and luxuriantly, could augment her revenue by utilizing it too. The tree is largely resorted to by the Ophidia family.

FODDER.—J. C. London, F.L.S., H.S., &c. (1829), says:—"The branches being of a soft, spongy, juicy nature, cattle will eat them very well when cut into small pieces." I know that the taste is unpleasant, and from the fact of the leaves decaying on the tree—especially in the younger plants, which are within the reach of all cattle—this assertion seems rather doubtful.

Altogether the *P. odoratissimus* is a most interesting and valuable product of the vegetable kingdom; and it is to be regretted that a tree so very useful for economic purposes—from the root to the flower—is not cultivated and brought into use more largely.

F. R.

FREAK IN A *ZINNIA PAUCIFLORA* OBSERVED AND EXHIBITED

BY MR. FRANK ROSE, P.W.D.

[N. O. *COMPOSITÆ* (*ASTERACEÆ*).]

(*Syngenesia*—LINN. Sub-Order *TUBULIFLOREÆ*.)

It was Mrs. Caroline A. White who truly said that "the researches of modern botanists have done much to simplify and popularize a knowledge of the vegetable kingdom; but there are still sufficient mysteries in the organization, sensation, and self-motive power of plants to afford a wide field for inquiry and experiment; and the more we direct attention to these charming wonders, the more good we shall be doing to our readers, ourselves, and science."

Appropos of the above, I may as well here state—*en parenthesis*—that certain habits of the animal and vegetable kingdoms are analogous, of which I hope

to give some interesting facts in due course. The ancients believed that plants and trees have instinct and vegetable *souls*, and looked upon them as animals! However, be that as it may, there is no doubt that the floral world has its *lusus naturæ* like animals, as will be perceptible in the specimen of the green flower of the *Zinnia pauciflora* herewith forwarded, obtained from my bungalow compound from among many hundred plants growing wild, whose corollas are of different delightful hues.

The plant from which this individual is obtained is *fac simile* to the others, except in the flower, and that its growth is stunted. The uncommon colour—green—I venture to say, is doubtless attributable to some chemical change which has taken place in the internal arrangement of this *only plant* from among a number of others. Science teaches us that the leaves of trees and grass, being inclined to be more dark than white, have a greater tendency to absorb than to reflect the solar rays. For instance, the grass and leaves are green, but they absorb all but the green rays. In Professor Henfrey's Botany, 2nd Edition, revised by Dr. Masters, we are told that "the various tints of colour are produced either by the interposition of colourless cells between those containing coloured juices, or by the superposition of cells with different colouring matter one over the other. Then how comes this one plant to be affected more than all the others which are contiguous to it?"

The most striking feature in this phenomenon I wish to bring to notice is the abnormal evolution of the corolla having leafy shoots or miniature plants 2 inches high, from whence another flower-bud is shooting—an unheard of *freak*, I think, in this genus! The Honorary Secretary of this section will, I am sure, be glad to explain to us the cause of this metamorphosis, which will be a very interesting lesson to florists who are not versed in teratology.

There are other green flowers on the same plant, but at present without any leafy shoots besides the extraordinary one now sent.

F. R.

NOTE ON THE ABOVE, BY SURGEON K. R. KIRTIKAR.

MR. ROSE'S specimen of *Zinnia pauciflora* is an instance of proliferation or proliferation, which means the production of one organ by another of a different kind, as that of cup-like appendages by leaves and of branches by flowers or even fruits. For an illustration of this sort of monstrous development, the reader is referred to figures 650 and 774 in Bentley's Botany at pages 286 and 344 respectively (4th Ed.). In the former is an instance of a flower of the Rose showing the axis prolonged beyond the flower and bearing true leaves; in the latter a monstrous Pear has its axis prolonged beyond the fruit and similarly bearing true leaves. In the 5th Edition of Lindley's *Elements of Botany* at p. 62, there is an illustration of the flowers of *Epacris impressa* changing into branches.

This metamorphosis is technically called descending or retrograde where the floral parts, i.e., petals or stamens or carpels become degenerated and are transformed into a leaf. This can be easily explained from the homologous nature of the different parts of a flower to the leaf. A flower in its widest sense is a multiple arrangement of modified or altered leaves. "Linnæus taught it, and Goethe proved it," says Lindley. He mentions an instance from the *Gardener's Chronicle*, in which a Rose is said to have its calyx tube absorbed, at least not manifest; the sepals half converted into leaves; the petals more than half changed into sepals; the stamens fallen off, apparently little changed; the exterior carpels partly in their customary state; those nearer the centre converted into small leaves; but the remainder upon the axis or centre, which had lengthened into a branch, carried up in every conceivable state of transition, until the last or uppermost carpel assumed the customary appearance of the leaves of the stem. A beautiful illustration is also given by Lindley at p. 63 of his "Elements" above referred to.

The most highly modified leaves of the flower, says Sachs, "are the stamens and carpels." By a freak of nature they may not develop into stamens or carpels, or the stamens and carpels may degenerate into leaves at any time. But though such instances are numerous, they constitute merely a phenomenal transition of an exceptional kind, not necessary for the completion of the life-history of a plant. The floral axis as a general rule ceases to grow at the apex as soon as the sexual organs make their appearance, or even earlier. But in singular or abnormal cases like the one exhibited by Mr. Rose, and *normally in Cycas*, says Sachs, "the apical growth of the floral axis recommences, again produces leaves, and sometimes even a new flower."

K. R. K.

PROCEEDINGS OF THE SOCIETY DURING THE QUARTER.

THE usual monthly meeting of this Society took place on Monday the 5th of July, and was largely attended. Dr. D. MacDonald presided.

The following new members were elected:—Mr. E. C. K. Ollivant, Mr. J. A. Betham, Dr. O. H. Channer, Mr. Frank Rose, Mr. F. Chambers, Mr. H. Bromley, Mr. W. J. Holland, Mr. T. B. Fry, Mr. J. H. Steel, Colonel F. W. Major, Mr. Chester Macnaghten, Mr. H. E. Andrewes, Mr. J. Maguire, Mr. G. A. Anderson, Rev. J. E. Abbott, Mr. Cowasji M. Dadabhoy, and Dr. Temuljee B. Nariman. Mr. L. de Niceville, of the Calcutta Museum, was elected an honorary corresponding member of the Society.

Mr. H. M. Phipson, the Honorary Secretary, acknowledged the following contributions to the Society's collections since the last meeting :—

Contribution.	Description.	Contributor.
1 Kestrel (alive).....	From Khandalla	Mr. Wm. Shipp.
1 Sea-snake	<i>Hydrophis curta</i>	Capt. W. P. Kennedy.
1 do.	<i>Pelamis bicolor</i>	Do.
A quantity of Corals ..	From Arabian Coast	Mr. E. H. Aitken.
3 Eggs	<i>Alcippe poiocephala</i>	Do.
A quantity of Birds' Skins and Geological specimens.	From Bhooj	Mr. A. Newnham.
3 Snakes	<i>Zamenis diadema</i> and <i>Echis carinata</i> .	Do.
A quantity of Fossils...	From Beluchistan	Dr. H. Yeld.
A Crow's Nest.....	Made of bottling-wire.....	Mr. W. M. Macdonald.
1 Snake's Skin (15' 5")..	<i>Ophiophagus elaps</i>	Dr. Bocarro.
3 Floricans' Skins .....	.....	Mr. D. Bennett.
Skin of Pine-marten...	<i>Martes abietum</i>	Capt. Olivier.
3 Ibex's Skins.....	<i>Capra sibirica</i>	Do.
2 Snakes	From Mahableshwar	Mr. J. C. Anderson.
1 Snake (41½')	<i>Cynophis malabaricus</i> ...	Miss Dewar.
1 Elephant's Tooth.....	Found at Khandalla	Mr. G. W. Terry.
6 Crocodiles' Eggs (since hatched).	From Tulsi Lake	„ Rienzi Walton, C.E.
2 Snakes	{ <i>Dipsas gokool</i> . <i>Trop. stolatus</i> . }	Lieut. Barnes.
Skin of Albino Mongoose	From Baroda.	Mr. H. Littledale.
2 Young Crocodiles	From Tulsi Lake	„ Nowrojee H. Katrak.
1 do. ....	.....	„ C. A. Stuart.
2 Snakes (alive).....	.....	„ K. D. Naegamvala.
1 White-tailed Porcupine (alive).	<i>Hystrix lencura</i>	„ A. S. Ritchie.
1 Snake	<i>Trimeresurus anamallensis</i>	„ G. A. Barnett, C.I.E.
1 Camel's Skull	From Sind	„ E. M. Walton.
1 Saw-fish's Snout	<i>Pristis antiquorum</i>	Do.
1 Sea-snake	<i>Hydrophis Guntherii</i>	Capt. Fenton.
A quantity of Fish and Crustaceans.	From Alibag	Mr. W. F. Sinclair, C.S.
1 Snake	<i>Gongylophis conicus</i>	Do.
Do.	<i>Onychocephalus acutus</i> ...	Do.
Ratel(or Honey-badger).	<i>Mellivora indica</i>	Mr. R. A. Riddell.
1 Snake	<i>Silybura bicatenata</i>	„ G. Vidal, C.S.
1 Musang	<i>Paradoxurus musanga</i>	„ W. F. Hamilton.
1 Booby (alive) .....	.....	„ W. F. Sinclair, C.S.
A quantity of Lizards...	From the Punjab	Major Yerbury, R.E.
1 Snake.....	<i>Zamenis diadema</i>	Do.
A quantity of Cobra's Eggs.	From Bijapur	Mr. E. Reinhold, C.E.
Head of 4-horned Antelope .....	.....	„ J. D. Inverarity.
A Land Tortoise	From Afghanistan	Major W. J. Morse.
A Rat	Probably a new species ...	Father Dreckman.
2 Snakes	<i>Silybura Elliotii</i>	„ H. E. Andrewes.
Part of a Porpoise's Skull	From Alibag.	„ W. F. Sinclair, C.S.
Large Snout of Saw-fish	.....	„ Eduljee A. Hormasjee.
1 Python (alive).....	<i>Python molurus</i>	„ H. M. Phipson.

MINOR CONTRIBUTIONS.

From Dr. T. S. Weir, Mr. C. B. Lynch, Mr. H. Curjel, Mr. M. C. Turner, Dr. Dalgado, Mr. F. Jefferson, Mr. E. C. K. Ollivant, Miss Johnston, Mr. F. C. Webb, Mr. A. F. Beaufort, and Mrs. Wright.

CONTRIBUTIONS TO THE LIBRARY.

Transactions of the Linnæan Society of New York, Vols. I. and II.

Records of the Geological Survey of India, Vol. XIX., Nos 1 and 2.

Journal of the Simla Natural History Society, Vol. I., Part 1.

Paper read before the Simla Natural History Society by Colonel H. Collett.

A vote of thanks was then passed to the ladies and gentlemen who had so kindly responded to the request of the Committee and had sent in birds in cages for exhibition at the meeting. The collection consisted of 122 specimens.

Father Dreckman exhibited two full-sized living specimens of the Green Pit-viper (*Trimeresurus anamallensis*) found at Khandalla, which differed in a very curious way as regards markings and colour.

Mr. Rich also exhibited some beautiful cases of stuffed birds from Australia and New Guinea.

THE usual monthly meeting of this Society was held on Monday 2nd August, Dr. D. MacDonald presided. The following new members were elected:—The Hon'ble F. Forbes Adam, Captain W. P. Kennedy, Mr. S. S. Bengallee, Mrs. Yorke Smith, Mr. F. deBovis, Dr. A. W. F. Street, Mr. P. C. Petit, Rev. H. Juergens, S.J., Mr. F. J. Daley, Mr. E. G. Colvin, C.S., Mrs. A. F. Turner, Khan Bahadur R. J. Ashburner, Mr. Dady M. Limjee, and Mr. Framjee D. Petit.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's collection during the past month:—

Contribution.	Description.	Contributor.
1 Crowned-crane.	<i>Ardea pavonina</i>	Victoria Gardens.
1 Chameleon.....	<i>Chamaeleo vulgaris</i>	Mr. H. Barrett.
1 Snake	<i>Tropidonotus quincunciatus</i> .	Miss Dewar.
A quantity of Tree-crabs	From Mahableshtar	Do.
1 Lizard (alive)	<i>Varanus dracœna</i>	Mr. W. Killen.
3 Cobras	<i>Naga tripudians</i>	„ H. Littledale.
1 Panther	<i>Felis pardus</i>	Victoria Gardens.
1 Wild Ass (Cutch)	<i>Equus onager</i>	Col. Nutt.
4 Snakes	<i>Cerberus rhynchops</i>	Mr. W. F. Sinclair, C. S.
.....	<i>Gerarda bicolor</i> (?)	Do.
.....	<i>Onychocephalus acutus</i> ...	Do.
2 Lizards.....	<i>Varanus dracœna</i>	Do.
A quantity of Crustaceans.	From Alibag	Do.
70 Birds	From Ceydon	Mr. A. Newnham.
23 Snakes	Do.	Do.
42 Lizards	Do.	Do.
A quantity of Bactrachians.	Do.	Do.
A Fœtus of the Mouse-deer.	Do.	Do.
A quantity of Insects.	Do.	Do.

Contribution.	Description.	Contributor.
Quantity of Corals, Shell-fish, and Radiata.	From Ceylon.	Mr. A. Newnham.
A Goat	From Africa	Victoria Gardens.
A quantity of Sea-shells.	From Aden	Mr. J. D. Katelee.
1 Snake.....	Dipsas gokool	Col. Walcott.
1 Hoopoo	(Mounted in England).....	Capt. Miller.
Specimen of Arraq and Attar.	Made from the Pandanus odoratissimus.	Mr. Frank Rose.
Specimens of Jasper Pudding-stone.	From Banda	Do.
1 Hog-deer	Axis porcinus	Victoria Gardens.
A quantity of Geological specimens.	From the volcano on Barren Island, Bay of Bengal	Mr. F. J. Daley.
3 Japanese Fish (alive)....	.....	Rev. Fr. Dreckman.

MINOR CONTRIBUTIONS.

From Mr. A. F. Turner, Mr. R. MacEwen, Mr. John Fleming, Mr. S. Hodgart, Miss Whitcombe, Mr. A. H. Follet, Mr. J. A. Guider, and Mr. John Dawson.

CONTRIBUTIONS TO THE LIBRARY.

Paper on the Birds of Aden, by Major J. W. Yerbury, R. A.

The Utilization of Minute Life, by Dr. T. L. Phipson.

A Manual on the Diseases of the Elephant, by Mr. J. H. Steel.

EXHIBITS.

A Japanese Dwarf-tree, by Colonel Walcott, and another by the Hon. Mr. Justice Birdwood; 1 Orchid (in flower) (*Phaleonopsis rosea*), by Mr. M. C. Turner; a 4-horned Ram (from Arabia), by Mr. C. E. Kans; 1 double Cocoanut (from Seychelles Islands), by Mr. A. S. Panday.

THE FUNGI OF BOMBAY.

Surgeon K. R. Kirtikar exhibited a few fresh fungi collected in and round Bombay. The spores of the Bhopud or Lycoperdon or Puff-ball and *Hydnum aureatum* were exhibited under the microscope, showing the extreme minuteness of the spores of the latter as compared with the spores of the former. Dr. Kirtikar observed that fungi form a very interesting form of plant-life, and, though spoken of somewhat contemptuously as consisting of mushrooms and toadstools, supply the student of Nature with an infatuating subject for observation and amusement. It was a subject, he said, by no means easy of study in this country, especially as previous Indian botanists had paid no special attention to the Cryptogams. Whatever the difficulties, fungi and the other cryptogams, or flowerless plants, afford an interesting field, and would amply repay any trouble that is taken in investigating this unexplored field of some of the most interesting objects in nature. Places around Bombay at this time of the year, when there is so much heat and moisture in the air and in the ground, supply abundant materials for a thorough investigation of this hitherto neglected department of botany. They are not mere toadstools all

these fungi, he said, though he showed a tiny toad which he had found sitting on one of the Agarici exhibited. The toads, he said, found not only a stool to sit on, but also a table where they could find their food, as there were numerous earth-worms crawling on the adjacent Polyperi. The fungus known to the natives of the country as Phanasamba was a polyporus, and used as a medicinal agent. The Puffball, known as Bhodiphod or Bhopud (*i. e.*, "Cleaver of the soil"), and scientifically known as a variety of Lycoperdon, was, he said, considered a delicacy when properly seasoned and cooked fresh from the field. It appeared on the first fall of the rains in the monsoons. The true mushroom which is sold in the English markets as *Agaricus campestris*, is also found in this country abundantly, but it is yet too early to find the same just now. It must however be admitted that several pounds of much nutritious food are thrown away as useless on account of want of proper knowledge of the various classes of edible and poisonous fungi. It is not everybody that can relish the musty smell of the varied members of the Fungal tribe, nor is it that the delicacies will always agree with the inner man. But there is hardly any doubt that every student of Nature will find immense delight in scanning the minute threads and spores, and the mycelium or spawn that go to build up the delicate structure of these cellular plants. It is not from the gastronomic point of view that he discoursed, he said, on the fungi, nor was it that he wanted to tell whether this or that mushroom was edible or poisonous, and whether it would do credit to a generous and hospitable host to place before his guest at dinner Indian mushroom toast or stewed or curried toadstools *à la Indienne* ! Nor did he pretend, he said, to initiate an energetic mercantile firm into the mysteries of fungus-trade, and encourage a body of speculators to bottle up a few edible varieties and send them to Crosse and Blackwell to try their fate in an English market. All he urged on that evening on behalf of those interesting objects in nature which lie unnoticed was that they had an everlasting interest to the student of Science, and if by such occasional display of fungi the Natural History Society of Bombay encouraged the study of an unexplored field, the Society will have accomplished one of its principal objects. To the student of Medicine the fungi have a special interest, now that fresh accessions are being daily made to our already vast knowledge of bacilli. A thorough acquaintance with their life, history, and their surroundings, and an acquaintance with their habits and functions, are essential before we determine whether they are the cause of disease, concomitants of it, or the mere harmless results of it as any other objects in nature. Fungi of the minutest kind have been known to exist on other larger fungi, apparently not affecting their host with disease or causing its death. Why should not bacilli exist in man without causing disease ? All this has to be known. It was not his intention however, he said, to enter on a medical disquisition, but that he touched the subject incidentally. He then showed from amongst the specimens of fungi some of the typical Agarics, several polypori beautifully tinted, a beautiful golden yellow-spiked *Hydnum*, the gelatinous ear-like *Auricularia*, some needle-like *Claviarei*, thus illustrating one of the important divisions of fungi known as the *Hymenomycetes*, so called from their possessing the hymenium or fruit-bearing, or rather spore-bearing, surface exposed to the air.

MEMORY AND REASON IN ANIMALS.

Mr. Sterndale then read a paper on "Memory and Reason in Wild Animals." He said that the beginnings of instinct, or he would rather call it reason, began very low down in the scale of animal life, as low down as the Rhizopoda, and he traced it gradually upwards through the Mollusca and Insecta to birds, and from them to the larger animals. He gave some interesting cases of instinct, which he was careful to separate from reason, in monkeys, which rejected certain deadly poisons hurtful to them, and readily took other poisons equally deadly to man and other creatures but which had no effect on them. He then gave cases of reasoning in monkeys and other mammals, and passed on to examples of memory, illustrating his cases by tigers, elephants, horses, &c. He pointed out that in desert islands, untrodden by human foot, there was no instinctive dread of man shown by wild animals. One curious genus of Marine mammalia, Steller's Rhytina, has been exterminated by sailors owing to this over-confidence; but the advent of man is followed by the loss of this trusting nature, and this is the outcome of reasoning faculties. The wild birds soon see that to confide is to be knocked on the head. Birds, he said, exceeded mammals, with the exception of monkeys, in imitative power. Parrots are made to talk, other birds to whistle. There is no such mimicry amongst mammals, with perhaps the exception of the dog, the bark of which is said to be the unconscious mimicry of the gruffness of the human voice. Wild dogs and wolves cannot bark but only howl. Domestic dogs which run wild lose in a few generations the power of barking and revert to the howl, as in the case of those on the island of Juan Fernandez; on the other hand, wolf cubs brought up with domesticated dogs learn to bark. He concluded by saying:—"I must however not tax your patience any longer. Did time permit of it, I could give many curious instances of the sagacity of wild animals, their skill in avoiding traps, and their own cunning in circumventing others. The most marvellous creature is the North American wolverine or glutton, regarding which much has been written by Dr. Elliot Coues. I think he heads the list for intelligent rascality, and I recommend such of our members as are interested to turn up the abridged account of it in the second volume of Cassell's Natural History, and they will be amply repaid for five minutes reading. We have nothing like this thoroughpaced villain amongst our comparatively well-behaved denizens of the jungles. I will wind up with a short certificate to his bad character from Dr. Coues:—'The desire for accumulating property seems so deeply implanted in this animal that, like tame ravens, it does not appear to care much what it steals, so that it can exercise its favourite propensity to commit mischief. An instance occurred within my own knowledge, in which a hunter and his family, having left their lodge unguarded during their absence, on their return found it completely gutted—the walls were there, but nothing else. Blankets, guns, kettles, axes, cans, knives, and all the other paraphernalia of a trapper's tent, had vanished, and the tracks left by the beast showed who had been the thief. The family set to work, and by carefully following up all his paths, recovered, with some trifling exceptions, the whole of the lost property.' It is well I may say for our Indian police that we have not wolverines among our criminal classes in this country."

The proceedings soon afterwards came to a close.

THE monthly meeting of this Society was held on Monday, the 6th September 1886. Dr. D. MacDonald presiding.

The following new members were elected :—Mrs. John Hay Grant, Captain H. G. E. Swayne, R. E., Mr. K. D. Ghandy, and Mr. S. K. Kambata.

Mr. H. M. Phipson, the Honorary Secretary, then acknowledged the following contributions to the Society's collections during the past month :—

Contribution.	Description.	Contributor.
A quantity of Butterflies	From the Punjab	Major J. W. Yerbury, R.A.
6 Species of Corals.....	From the Mergui Archipelago	Mr. F. J. Daley.
1 Crocodile's Skull	<i>Crocodilus palustris</i>	Do.
Eggs of Monitor	<i>Varanus microlepis</i>	Do.
A quantity of Coralines.	.....	Do.
1 Snake	<i>Tropidonotus quincunciatus</i> .	Mr. F. R. A. Montgomery.
A quantity of Bats.....	From Oorun	„ E. H. Aitken.
14 Snakes	From Saugor, C. P.	„ H. E. Barnes.
Nest and Eggs of the White-eyed Tit.	From Poona	„ R. C. Wroughton.
A quantity of Sponges, Coralines, Crustaceans, Sea-snakes, Fish, and other Marine Animals.	From the Persian Gulf	Capt. E. Bishop.
1 Tree-cat	<i>Paradoxurus musanga</i>	Mr. J. A. Simpson.
1 Crested Hawk-eagle ..	<i>Spilornis cheela</i>	„ H. Littledale.
1 Snake.....	<i>Lycodon aolicus</i>	Col. Portman.
22 Birds' Eggs.....	From Ahmadabad	Capt. F. B. Peile.
1 Markhor's Head	<i>Capra megaceros</i>	Do.
1 Orial's Head	<i>Ovis cycloceros</i>	Do.
1 Jungle-cat's Skin.....	<i>Felis chaus</i>	Do.
7 Rats	From Surat	Mr. F. Gleadow.
18 Lizards	Do.	Do.
3 Snakes (alive)	Do.	Do.
6 Rats	Do.	Do.
A quantity of Insects...	Do.	Do.
A quantity of Crustaceans	Do.	Do.
1 Lizard	<i>Eublepharis Hardwickii</i> ...	Mr. W. Willard.
1 Snake	<i>Tropidonotus punctulatus</i> .	„ W. F. Sinclair, C. B.
A quantity of Fish and Marine specimens.	From Alibag	Do.
1 Dolphin's Skull	<i>Delphinus plumbeus</i>	Do.
A quantity of Turtles' Eggs.	From Alibag	Do.
A quantity of Sea-shells	Do.	Do.
1 Porpoise, with 2 young ones.	<i>Neomeris kurrahiensis</i> ...	Do.
1 Sea-turtle (alive).....	Covered with Acorn Barnacles.	Do.
A beautifully stuffed specimen of the Duck-billed Platypus.	From Tasmania	Mr. E. M. Walton.
1 Stripe-necked Mongoose.	<i>Herpestes vitticollis</i>	„ N. S. Symons.

MINOR CONTRIBUTIONS.

From Mr. C. W. L. Jackson, Captain Becher, Mr. Thomas Lidbetter, Mr. Mitarachi, Mrs. Owen Dunn, Mr. Forrest, Mr. N. V. Mandlik, Major Morse, Mr. H. Bromley, Mr. C. P. Lynch, Mr. H. Wise, and Mr. Krishnarao V. Ranjit.

CONTRIBUTIONS TO THE LIBRARY.

Records of the Geological Survey of India, Vol. XIX., Part 3.

Insects of India (E. Donovan), by Mr. W. Shipp.

Foreign Butterflies, by Mr. W. Shipp.

Foreign Moths, by Mr. W. Shipp.

Reptiles of Sind (J. Murray), by the Author.

Transactions of the N. S. Wales Linnæan Society, Vol. I, Part 1.

Magazine of Natural History, Vol. XVIII., Nos. 103 and 104, from Mr. W. H. Littledale.

Mr. E. L. Barton exhibited one tiger's head and two panthers' heads, mounted by himself.

The following papers were then read :—

A Matheran Seed-traveller, by Dr. D. MacDonald.

Links in the Mammalian Chain, by Mr. R. A. Sterndale.

Pollen Grains, by Dr. Kirtikar.

A MATHERAN SEED-TRAVELLER.

Dr. MacDonald said :—"Members of the Natural History Society who have visited Matheran in the hot-weather may have noticed seeds with a beautiful crown of spreading hairs—termed *pappus* or *coma* by botanists—carried by the wind, sometimes along the ground, sometimes high in the air. On account of their buoyancy, these wind-wafted seeds are often carried to considerable distances from the parent plant. Several kinds of plants on summit or sides of Matheran Hill produce comose seeds, but perhaps the seeds of which I now show some specimens are the most beautiful. When I first saw these seeds in May of this year, I could not determine their botanical origin, even approximately; but when the then Superintendent of Matheran, Dr. MacDougall, kindly obtained for me some of the leaves of the plant, as well as a few of the maturing fruits, I was able to refer the plant to one of two very closely allied Natural Orders or Families—the *Apocynaceæ*, or Dogbane Order, to which plant so familiar in Bombay as the *Allamanda*, the *Tabernaemontana*, *Vinca rosea*, *Nerium oleander*, *Beaumontea grandiflora*, and others belong; or the *Asclepiadaceæ* or Milkweed Order, of which the *Asclepias curassavica*, the *Stephanotis*, and the *Hoya carnea* or Wax-plant are well known in Bombay. These two Orders are very closely allied, and were at one time grouped together under the name *Apocynaceæ*. The two are now separated, the distinguishing characters of the *Asclepiadaceæ* being—(1) the *stigma*, which has five rounded angles provided with either cartilaginous corpuscles, or a gland which retains the pollen masses, the stalk or *caudicle* of the pollen masses being attached in this way to the stigma, and (2) the peculiar *pollinia* or pollen masses which are developed by the stamens, instead of the ordinary pollen grains produced by the stamens in the order *Apocynaceæ*. In the *Asclepiads*, when the pollen masses adhere to the stigma, the pollen cells simply push the pollen tubes into the lateral and inferior stigmatic surfaces, and thus self-fertilization is effected."

Dr. MacDonald then contrasted the pollen masses found in the Natural Order *Asclepiadaceæ* with those in the Order *Orchidaceæ*, or Orchid Family, in which the pollen masses possess a viscid gland at the base of the stalk or caudicle.

This however was not intended as a means of retaining the pollen masses in the flower in which it was produced, but rather as a means of being carried away to other flowers, as it adhered readily to anything with which it came in contact. As insects were frequent visitors, especially bees and moths, they were often the agents in effecting the cross-fertilization which is the rule in this Order. Pollen masses from the two Orders were shown under microscopes. Returning again to the comose seed, Dr. MacDonald stated that he had identified the plant as the *Anodendron paniculatum* of Dalzell and Gibson's *Bombay Flora*, or the *Gymnema nipalense* of Hooker's *Flora of British India*, the native name being *Lamtani*.

The identification of this plant illustrated the great value of the natural system of classification as compared with the artificial or Linnæan system. The small twig, with its milky juice, the leaves, and the fruit containing the comose seeds, supplied data sufficient to make it certain that the plant belonged to one of two Orders ; and this without the flower, without which any one working on the Linnæan system could not take a single step, as the whole system was based on the parts of the flower.

Dr. MacDonald then pointed out that the stalk of the fruit turned back on itself so as to make the face or side on which it opens turn downwards. As the fruit matures the seeds become loose in the fruit, and when it splits open, as the seeds fall out the wind expands the crown of hairs, and they are thus launched on their voyage of life. The comose crowns, acting as parachutes to prevent the seeds falling at once to the ground, after a time very readily separate, leaving the seeds to germinate where they fall when the rains come.

Before concluding, Dr. MacDonald recommended members who might be interested in the wonderful examples of adaptations of means to an end which occur so frequently in plants to read such books as Sir John Lubbock's recent volume—one of the Nature Series—entitled *Flowers, Fruits, and Leaves*. Although dealing almost exclusively with English plants, any one reading such a book might learn to regard the plants they saw, even in their own compounds, with more interest than hitherto.

LINKS IN THE MAMMALIAN CHAIN.

Mr. Sterndale then read a paper on some links in the Mammalian Chain illustrated by drawings. He said :—"It is common enough to talk of the Animal kingdom as one great chain—and so it is—link is hooked on to link till we find that we are at last the ten billionth cousin of the cabbage we are eating, and so our consciences accuse us of practising homœopathio cannibalism ! You may think this is exaggeration ; but look at the *Campanularia*, of which I give here a magnified sketch ; it looks like a plant, it has buds and flowers, and is propagated, we may say, by cuttings, but it is an animal—a Zoophyte—yet how little removed is it in its life from the *Drosera rotundifolia*, the Sun-dew, and other carnivorous plants, which, with surprising life-like attributes, not only catch flies and other insects, but hold them till partly digested.

"These are links which carry us on to our cousin the cabbage, but I do not intend to trace out the pedigree so far. Our time would not permit of such extensive research, so I propose only to give a few of the most curious links in the chain as far as the mammals go. The missing link of course we have not

found yet, nor shall we ever find it, for the impassable gulf of intellect separates the brute from man, and no monkey that ever was created will bridge over the gap; but the barrier of intellect does not operate between ordinary mammals. There have been from time to time abnormal creatures brought forward as missing links, but they have always been human beings with only some monkey-like resemblances.

"Of all those I have seen, the best was a little girl, exhibited about three years ago in London, called *Krao*, or the Missing Link. She was without doubt an ordinary child, very hairy, of the same type as the Burmese family lately exhibited here; in fact, she came from the same part of the world, not from Burma, but from the adjacent kingdom of Siam. The points dwelt upon were her hairiness, flexibility of her joints: she could lay her fingers back till they touched her fore-arm; a habit she had of stuffing things into her cheek pouches; and last but not least the way in which the hair on her fore-arms turned upwards as in the monkeys and not downwards as in men. I looked well at the child, who seemed about six or seven years of age, and found that she was an ordinary human being, a little more hairy than usual: the flexibility of her hands was merely a matter of training, as also was the habit she had of stuffing her cheeks with grapes, &c. The direction of the hair on her arms was curious, but not in itself sufficient to establish her claim as a link; so we start from the monkeys. The link between these and the insectivorous animals lies in the Lemurs, which retaining the four hands and some of the anatomical peculiarities of the monkeys, in form and face approximate the carnivorous animals. I have here a living specimen of the mungoose lemur.

"Then from these we go on to the bats. I am not sure that we are anatomically correct in this link, but no other position could be assigned to the flying lemur or *Galeopithicus*.

"The *Galeopithicus volans*, of which I have here a rough sketch, is either a link between the lemurs and the bats or the bats and the insectivora. Naturalists differ on this point. From certain structural peculiarities, I incline to place them before the bats, especially as they are vegetivorous, and therefore should lead on from the lemurs to the frugivorous bats, and not be placed between the insect-eating bats and the insectivora. The animal itself is somewhat like a lemur, but between its limbs it has a membrane exactly like that of the flying squirrel, which I here show you, only that it has this membrane continued round between the hind legs and including the tail as have some genera of bats; and it is supposed from observations made of its flight that this arrangement enables it to steer itself in its course from tree to tree. In the numerous families of the Order Insectivora there are many curious links, but I have not time to-night to go into them. Anatomically, we must carry on the Insectivora into Carnivora, but talking merely external resemblances, we find much more affinity with the Rodents. Mice and rats are reproduced in shrews: the squirrels are externally like the tupaia. The porcupines have their counterparts in the hedgehogs, and the jerboas in the jumping shrews. A curious instance of similarity is to be found in the squirrels and tupaia. This latter animal is a tree-shrew with a long bushy tail, and when it was first discovered it was considered to be a squirrel till dissection proved it to be an insectivore.

There was subsequently found in the Malayan Peninsula, and I have seen one specimen from Burma, a long-nosed squirrel (*Rhinosciurus tupaoides*), which closely resembles the tupaia.

‘ However, I will bring home to you a still more familiar example in the case of the so-called musk-rat—that most maligned and persecuted little creature which I always encourage in my house, whilst other people destroy it wherever it is found. This miscalled rat is a true shrew, utterly incapable of gnawing a hole through a door or box, and therefore much mischief done by true rats is wrongfully laid to its charge; it comes into your houses for an object which should gain it thanks and protection, and not the violent death it usually meets; it comes to destroy cockroaches, centipedes, scorpions, and other creeping horrors, and its only offensiveness lies in its powerful odour, which however it only emits when frightened or hurt. I have let one run quietly *five* times over a clean pocket handkerchief without any smell being perceptible afterwards, and the old story of its tainting bottles of beer and wine by simply running over them is a myth. In the old days, when beer and wine were bottled largely in this country, muskratty liquor was common. The bottles were not properly cleaned; but how seldom do you now hear of the complaint; it is one of the old Anglo-Indian stories on a par with the cobra in each boot and a scorpion in every keyhole, to say nothing of tigers sitting and licking their lips in the back verandah waiting for the baby! I have had tame musk-rats and found them smell less than other pets, certainly not so bad as hedgehogs. At Nagpore a wild one would come out at my call and take grasshoppers from my fingers.

“The most interesting links in the carnivora are those between the cat and dog. The best known is that of the cheeta, of which I have got here a rough sketch; but he is a true cat, his dentition and internal anatomy are strictly feline, though his claws are not retractile and his form is somewhat dog-like, with long legs and thin body, so he can hardly be called a link. We must go from the cats to the civets and then on from the civets to dogs. There is a onrious animal in Madagascar called *Cryptoprocta ferox*, which is a perfect link between the cats and the civets. It is semi-plantigrade, keeping a large portion of the sole of the foot to the ground, and not walking on the tips of its toes like the cats, yet it possesses retractile claws. The skull partakes of the characteristics of both families, and the teeth differ only from the cats in having one more premolar. It is a very savage little creature, muscular and active, and so was appropriately termed *ferox*. The civets are connected with the hyæna by the sard-wolf, a South African animal about the size of a jackall, and in general appearance like a young striped hyæna. It is called *aard* or *earth*-wolf from its habit of burrowing in the ground. The hyænas again are linked on to the dogs by the *Lycæon* or Cape hunting-dog, or hyæna-dog. Here is a rough sketch of one which shews the likeness to both families: the skull is dog-like, but the animal has only four toes on each forefoot instead of five.

“We come now to the Bear family, and we must go back to the cats for a link. No two animals could be more dissimilar than the cat and the bear. Not only are there internal anatomical differences but externally they are unlike the one is light and springy in action, the other heavy and shuffling. The

tiger, which is the type of all cats, has but a few sharp cutting teeth which work on each other like a pair of scissors. The bear has more molars, and these with flat crowns, which enable him to grind his food instead of chopping it. The tiger steps lightly on the tips of his toes, with his heel well raised. The bear puts the sole of his foot down flat on the ground. I show you here skeletons of the two animals which will explain what I mean. Now to link the bears with the cats comes a little animal which I have seen in Darjeeling called the *wah* or panda (*Ailurus fulgens*), the red bear-cat. It is bat like in appearance and has semi-retractile claws, but anatomically it is a bear. A larger animal has been found in Eastern Tibet by the Abbe David, and has been called the *Ailuropus*. Only one of these curious creatures has been discovered, and it is still more a link between cat and bear than the other. The *Ailuropus melanoleucos* is about four to five feet in length. The specimen secured measured 4' 10." It is bear-like, as you will see from the rough sketch; but it is only semi-plantigrade, and its skull exhibits both feline and ursine characteristics; its dentition is feline as regards the premolars, but the true molars are ursine.

"The skull has also a considerable elevation of the occipital crest, and the zygomatic arches are enormous, more so than in any other carnivorous animal: both these are decidedly feline, as you will observe on looking at these skulls of tiger and bear.

"The racoons and the glutton link the bears on to the badgers and weasels, and so on to the otters and sea-otters, and from the last we come to the marine carnivora—the walruses and seals. The sea-otter, though not reckoned among the marine carnivora, is quite as amphibious as a seal; it is seldom seen on land, though it keeps close in-shore. It has a curious way of floating on its back, and can sleep in that position, and the females do so, holding their little ones between their fore paws.

"From these animals we begin to link on towards the whales. The outward form begins to be fish-like, though the skeleton internally preserves its mammalian character in full; but the hands and feet lose their grasping powers, and being enclosed in fingerless gloves and stockings, as it were, become mere paddles for swimming. Nothing can be more awkward than a seal or walrus on dry land, yet how graceful in the water. The transition from a seal to a whale or a porpoise is easy to be understood, and here is an argument against the development theory, which is generally understood to be a progression from a lower to a higher standard. If such transitions take place at all, it would be reasonable to suppose that the porpoise evolved from the seal, for it is not in the fitness of things for a whale or a porpoise to go flopping about on dry rocks till the friction produced legs, whereas we all know that the permanent disuse of any member will lead to its deterioration; and therefore if we are to have an evolution theory at all, let us suppose that seals took to remaining in the water so long that having no use for legs they left them off. In the cetaceans the upper portion of the skeleton retains the normal mammalian form, but the rest is merely a vertebral column; hind legs disappear entirely, although the rudiments of small

pelvic bones are to be found embedded in the flesh, like the clavicles of the tiger, useless save as a clue.

"Now I have taken up my full share of your time, and have but half gone through my subject. The links between the Rodents, Proboscidea, Ungulata, and Ruminantia must remain over for some future occasion if the subject be deemed of sufficient interest to call for more of it."

POLLEN GRAINS.

Dr. Kirtikar exhibited under the microscope the pollen grains of the Rose hibiscus, *Canna indica*, *Calotropis gigans*, *Calophyllum inophyllum*, *Pandanus odoratissimus*, *Amaryllis*, *Garuga pinnata*, &c., and went on to explain what pollen was. He said it was commonly a yellow powder, sometimes gritty, often impalpable, and was the product of the male portion of the reproductive organs of flowering plants or phanerogams called stamens. It formed an essential element in the process of fertilization or impregnation of the ovule. The pollen of the male organs or stamens and the ovule of the female organs or pistil by themselves, *i. e.*, alone and untouched or unaffected by each other, were powerless in the propagation of the species to which they belonged. The pollen had to come into contact, either directly or indirectly, by being carried from stamens to stigma, from flower to flower, by the busy bee and brilliantly coloured butterflies and moths, or by simple currents of air, winds, and storms. Mr. Blockley's researches have shown that hay fever was caused by the migration of pollen grains of grasses, lilies, roses, and other plants. Professor Otto Thome, of Cologne, the lecturer said, had stated that in forests consisting of those trees which bore catkins, immense clouds of pollen were seen floating in air, at the time of pollination, which were sometimes carried to the earth by showers of rain and there formed the so-called *sulphur-rain*. Special contrivances, Dr. Kirtikar said, existed in water-plants for the utilization of pollen grains. Submerged plants always threw their flower-stalks above the surface of water, as in *Trapa sagitta* and water-lily. *Vallisneria spiralis* however had a remarkable mode of fecundation. The male flowers containing the pollen were seated on very short pedicels at the base of the leaves, often several feet below the surface of the water. The female flowers on the contrary had very long pedicels, which at a particular time became greatly elongated and raised the flower to the surface of the water. The male flowers next became detached from their pedicels, rose to the surface, were floated among the female flowers, and thus fertilized the ovule. After this had been accomplished—and this is the most remarkable part of the whole process—the female flower coiled up spirally and the fruit ripened beneath the water. The subject of cross-fertilization which Darwin had so ably followed, the lecturer said, was a study by itself vast and interesting, whereby crossing between different flowers of the same plant, or between flowers on different plants of the same species, was explained.

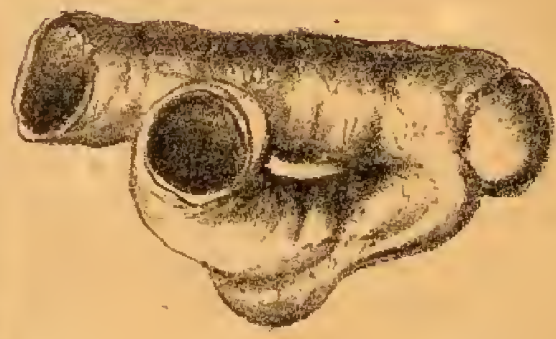
Pollen, he said, was discharged generally at the time of the opening of the flower, *i. e.*, from the time it completed its bud-state to the time it expanded. The process of pollen-discharge however, he said, might and did continue for some time after the flower had fully opened, but that this happened

simply as the remnant of a process which had long since been complete, so far as fructification was concerned, that was to say, that pollen might go on discharging even after the ovule had been acted upon and fecundated. As a general rule, the period of the maturity of pollen and the suitability of the ovule for fertilization were simultaneous. It was noteworthy that in the Natural Orders Orchidaceæ and Asclepiadaceæ, direct fecundation could never take place. In that part of the subject, Dr. Kirtikar said, Dr. MacDonald had anticipated him, and already ably spoken on the subject. An insect must intercede in these orders and transfer the pollinia from one orchid to another.

The pollen cells assumed a variety of forms. Thirty different forms were pictured by Dr. Kirtikar on paper and handed round to the meeting. The contents of the pollen grains, he said, were called fovilla, which consisted of coarsely granular protoplasm containing essential oil and starch globules suspended in finely atomized condition and varying in size from 1-4,000 to 1-30,000 of an inch. It was the essential oil, he said, that gave flowers their value in the world of perfumery.



N° 3



N° 4

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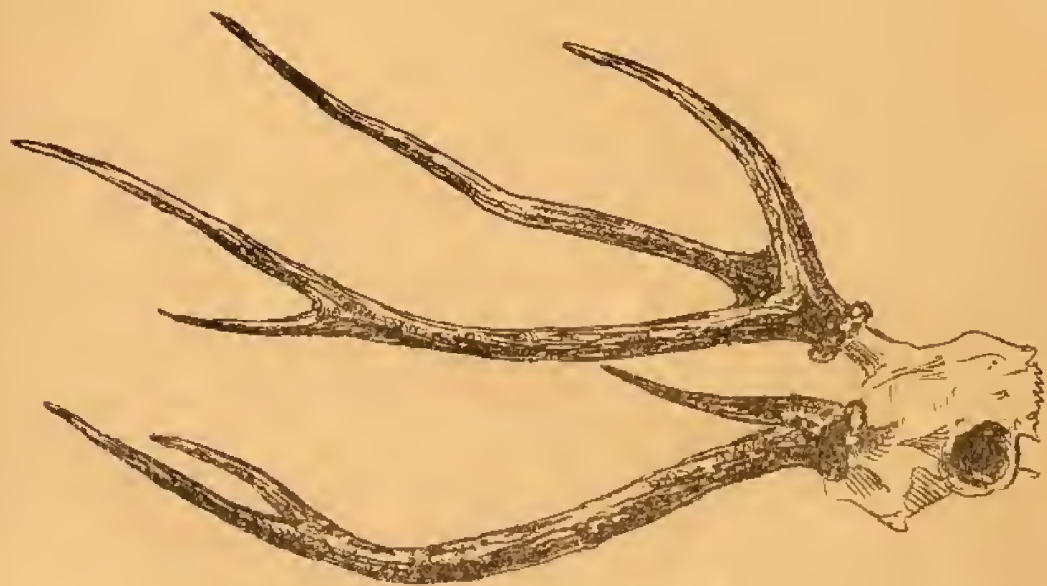
NEOMERIS KURRACHIENSIS. (Murray.)



JOEY - See Reversion to primitive types.



No 1



No 2

Abnormal Horns.